Karlsruher Institut für Technologie

Economathematics (M.Sc.)

Summer Term 2015
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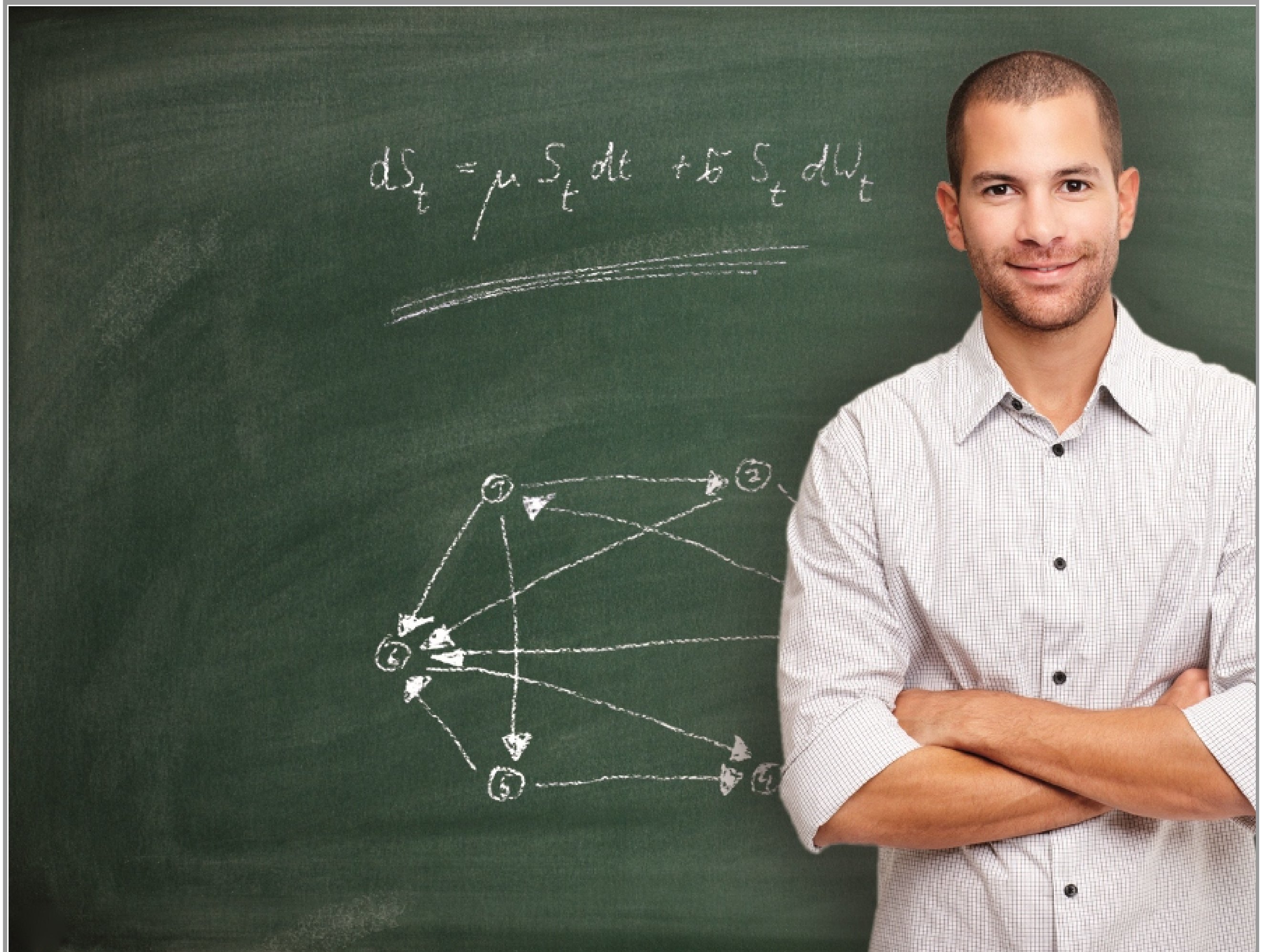
Department of Economics and Business Engineering
Department of Mathematics



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Contents

Studienplan für den Masterstudiengang Wirtschaftsmathematik am Karlsruher Institut für Technologie (KIT)

Fakultäten für Mathematik und Wirtschaftswissenschaften

Vorbemerkung

Dieser Studienplan soll die Studien- und Prüfungsordnung des Masterstudiengangs Wirtschaftsmathematik ergänzen, erläutern und den Studierenden konkrete Beispiele zur Organisation des Studiums aufzeigen.

1 Qualifikationsziele und Profil des Studiengangs

Ausbildungsziel des interdisziplinären Masterstudiengangs Wirtschaftsmathematik ist die Qualifizierung für eine berufliche Tätigkeit in den Bereichen Industrie, Banken, Versicherungen, Logistik, Softwareentwicklung und Forschung. Durch die forschungsorientierte Ausbildung werden die Absolventinnen und Absolventen insbesondere auf lebenslanges Lernen vorbereitet.

Fachliche Kernkompetenzen:
Absolventinnen und Absolventen verfügen über eine breite Kenntnis mathematischer und wirtschaftswissenschaftlicher Methoden, einschließlich spezifischer Methoden und Techniken in den Gebieten Analysis/Numerik/Optimierung, Stochastik, Finance/Risk Management/ Managerial Economics und Operations Management/Datenanalyse/Informatik. Sie sind in der Lage aktuelle, komplexe Fragestellungen in diesen Bereichen zu analysieren und zu erklären. Dabei können sie Methoden aus den Wirtschaftswissenschaften und der Mathematik verwenden, kombinieren und interdisziplinär arbeiten. Basierend auf diesen Methoden vermögen sie praktische und forschungsrelevante Fragestellungen zu bearbeiten. Absolventinnen und Absolventen verfügen über ein geschultes analytisches Denken und können selbständig und reflektiert arbeiten. Sie sind auch in der Lage sich zusätzliches Wissen für weiterführende Fragestellungen selbst anzueignen.

Überfachliche Kompetenzen:
Absolventinnen und Absolventen können Probleme in neuen und unvertrauten Situationen, die in einem multidisziplinären Zusammenhang zum Studium stehen, mit ihren erworbenen Fähigkeiten analysieren, bewerten und lösen. Sie sind in der Lage ihr Wissen selbständig zu integrieren, mit hoher Komplexität umzugehen und sie besitzen Ausdauer bei der Lösung schwieriger Probleme. Erhaltene Ergebnisse wissen sie zielführend zu dokumentieren, illustrieren und zu interpretieren. Dabei berücksichtigen sie stets gesellschaftliche, wissen-

schaftliche und ethische Randbedingungen. Sie können mit Fachvertreterinnen und Fachvertretern sowie mit Laien über Probleme und Lösungen auf wissenschaftlichem Niveau sprechen, argumentieren und einen Standpunkt verteidigen. Außerdem besitzen sie die Fähigkeit in einem Team zu arbeiten und können ihr Wissen zielführend einsetzen.

Lernergebnisse:
Die Absolventinnen und Absolventen können vertiefende mathematische Methoden in den Wirtschaftswissenschaften benennen, erklären und selbständig anwenden. Sie sind auch in der Lage den Einsatzbereich dieser Methoden zu identifizieren. Die Absolventinnen und Absolventen verfügen über ein Verständnis wirtschaftlicher Abläufe und können Stellung zu wirtschaftlichen Themen beziehen. Sie erwerben ein vertieftes Verständnis mathematischer Methoden aus den Bereichen Analysis/Numerik/Optimierung und Stochastik.
Im Profil Financial Engineering besitzen die Absolventinnen und Absolventen ein breites Wissen über finanzmathematische Modelle und Methoden sowie finanzwirtschaftliche Konzepte und Begriffe. Dies befähigt sie in diesem Bereich komplexe und innovative Aufgaben zu analysieren und die Ergebnisse zu beurteilen.
Im Profil Operations Research erwerben die Absolventinnen und Absolventen ein breites Wissen über mathematische und wirtschaftswissenschaftliche Modelle und Methoden der Unternehmensführung. Dies befähigt sie in diesem Bereich komplexe und innovative Aufgaben zu analysieren und die Ergebnisse zu beurteilen.

2 Gliederung des Studiums

Die Lehrveranstaltungen werden in Form von Modulen abgehalten, wobei die meisten Module aus mindestens einer Vorlesung (mit oder ohne Übung) oder einem Seminar bestehen. Jedes Modul schließt mit einer Leistungskontrolle ab. Der durchschnittliche Arbeitsaufwand wird in Leistungspunkten (LP) gemessen. Im Allgemeinen werden Module benotet. Die Note geht in die Endnote ein. Die Masterarbeit besteht aus einem eigenen Modul mit 30 LP. Insgesamt müssen im Masterstudium 120 LP erworben werden, etwa gleichmäßig verteilt auf vier Semester.

Der Masterstudiengang Wirtschaftsmathematik basiert auf den beiden Fächern *Mathematik* und *Wirtschaftswissenschaften*, die von den jeweiligen Fakultäten angeboten werden. Es müssen Module aus beiden Fächern in dem im Folgenden beschriebenen Rahmen belegt werden.

Fach Mathematik

Es gibt die folgenden vier mathematischen Gebiete:

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1. Stochastik
2. Angewandte und Numerische Mathematik/Optimierung
3. Analysis
4. Algebra und Geometrie

Es müssen mindestens 36 LP erworben werden, wobei 8 LP aus dem Gebiet Stochastik und 8 LP aus einem der Gebiete Angewandte und Numerische Mathematik/Optimierung oder Analysis kommen müssen. Im Studienprofil Financial Engineering müssen mindestens 8 weitere Leistungspunkte aus dem Gebiet Stochastik sein. Die restlichen 20 LP (bzw. 12 LP im Studienprofil Financial Engineering) müssen durch beliebige Prüfungen aus den genannten vier mathematischen Gebieten nachgewiesen werden.

Fach Wirtschaftswissenschaften

Es müssen je 18 LP aus den beiden Gebieten

1. Finance - Risk Management - Managerial Economics
2. Operations Management - Datenanalyse - Informatik

erworben werden.

Seminare

Des weiteren müssen zwei Seminarmodule über je 3 Leistungspunkte abgelegt werden, jeweils eines aus den beiden Fächern Mathematik und Wirtschaftswissenschaften.

Wahlpflichtbereich und Schlüsselqualifikationen

Weitere 12 LP sind flexibel zu erbringen. Insbesondere ist dadurch die Möglichkeit der fachlichen Vertiefung zur Vorbereitung der Masterarbeit gegeben. Mindestens 8 der 12 LP müssen aus den oben genannten mathematischen oder wirtschaftswissenschaftlichen Vorlesungsmodulen oder aus einem Berufspraktikum stammen. Mindestens 3 LP sind durch Schlüsselqualifikationen zu erbringen.

Masterarbeit

Die Masterarbeit wird in der Regel im vierten Semester geschrieben und ist mit 30 LP versehen. Sie kann in beiden beteiligten Fakultäten betreut werden und soll nach Möglichkeit ein für die Wirtschaftsmathematik inhaltlich und methodisch relevantes Thema behandeln. Voraussetzung ist eine angemessene Vertiefung im Themenbereich der Arbeit.

Fach Mathematik		Fach Wirtschaftswissenschaften
Stochastik **(8 LP)** **(bzw. 16 LP*)**	**WP Mathematik** **(20 LP)** **(bzw. 12 LP*)**	**Finance - Risk Management - Managerial Economics** **(18 LP)**
Angewandte undNumerische Mathematik / Optimierung oder Analysis **(8 LP)**		**Operations Management - Datenanalyse - Informatik** **(18 LP)**
Seminar (3 LP)		**Seminar (3 LP)**
Wahlpflichtbereich und Schlüsselqualifikationen (12 LP)		
Masterarbeit (30 LP)		

* im Profil Financial Engineering

3 Festlegung des Studienprofils (Schwerpunktbildung)

Im Masterstudiengang Wirtschaftsmathematik wird eines der drei möglichen Studienprofile *Financial Engineering* oder *Operations Research* oder *Klassische Wirtschaftsmathematik* gewählt. Während im letzten Profil eine maximale Flexibilität bei der Zusammenstellung der Module besteht, erfolgt bei den beiden anderen Studienprofilen durch die Wahl von Modulen aus bestimmten Bereichen eine Schwerpunktbildung.

Im Folgenden werden Umfang und Inhalt für die einzelnen Studienprofile spezifiziert. Im Fach Mathematik entsprechen die Modulnamen den Vorlesungsnamen, während sich im Fach Wirtschaftswissenschaften in der Regel verschiedene Vorlesungen zu einem Modul kombinieren lassen. Die Kombinationsmöglichkeiten sind im Modulhandbuch ausgeführt.

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Studienprofil Financial Engineering

Im Studienprofil *Financial Engineering* werden Vorlesungen aus moderner Stochastik und Analysis der Fakultät für Mathematik kombiniert mit methodenorientierten Vorlesungen aus dem finanzwirtschaftlichen Angebot der Fakultät für Wirtschaftswissenschaften. Die besondere Rolle der Stochastik in diesem Studiengang wird durch die verbindliche Wahl von 16 LP aus diesem Gebiet aus der unten stehenden Liste unterstrichen. Die verbindlichen 8 LP im Gebiet Angewandte u. Numerische Mathematik/Optimierung oder Analysis sollten ebenfalls der unten stehenden Liste entnommen werden. Weiter gelten die folgenden Listen für die 18 LP aus den Gebieten Finance-Risk Management-Managerial Economics bzw. Operations Management-Datenanalyse-Informatik. Auf Antrag an den Prüfungsausschuss können weitere Module zugelassen werden. Für die restlichen 12 LP aus der Mathematik können Vorlesungsmodule aus dem ganzen mathematischen Angebot des Modulhandbuchs gewählt werden.

Stochastik (16 LP)

Finanzmathematik in diskreter Zeit	8 LP
Finanzmathematik in stetiger Zeit	8 LP
Statistik	8 LP
Mathematische Statistik	4 LP
Asymptotische Stochastik	8 LP
Nichtparametrische Statistik	8 LP
Brownsche Bewegung	4 LP
Generalisierte Regressionsmodelle	4 LP
Steuerung stochastischer Prozesse	4 LP
Zeitreihenanalyse	4 LP
Finanzstatistik	4 LP
Lévy Prozesse	4 LP

Angewandte u. Numerische Mathematik/Optimierung oder Analysis (8 LP)

Optimierung und optimale Kontrolle für Differentialgleichungen	4 LP
NumerischeMethoden für Differentialgleichungen	8 LP
Steuerung stochastischer Prozesse	4 LP
Numerische Methoden in der Finanzmathematik	8 LP
Numerische Methoden in der Finanzmathematik II	8 LP
Funktionalanalysis	8 LP
Stochastische Differentialgleichungen	8 LP
Klassische Methoden für partielle Differentialgleichungen	8 LP
Kontrolltheorie	4 LP

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Finance - Risk Management - Managerial Economics (18 LP)

Finance 1	9 LP
Finance 2	9 LP
Finance 3	9 LP
Insurance Management I	9 LP
Mathematical and Empirical Finance	9 LP
Ökonomische Theorie und ihre Anwendung im Finance	9 LP

Operations Management - Datenanalyse - Informatik (18 LP)

Informatik	9 LP
Methodische Grundlagen des OR	9 LP
Mathematische Optimierung	9 LP
Stochastische Methoden und Simulation	9 LP
Stochastische Modellierung und Optimierung	9 LP
Energiewirtschaft und Technologie	9 LP

Studienprofil Operations Research

Im Studienprofil *Operations Research* werden Vorlesungen der modernen Optimierung und des Hochleistungsrechnens aus der Fakultät für Mathematik kombiniert mit methoden-orientierten Vorlesungen des Operations Research und der Datenanalyse aus der Fakultät für Wirtschaftswissenschaften. Die folgenden Module sind für die verpflichtenden 8 LP in Stochastik bzw. Angewandte u. Numerische Mathematik/Optimierung oder Analysis bestimmt. Weiter gelten die folgenden Listen für die 18 LP aus den Gebieten Finance-Risk Management-Managerial Economics bzw. Operations Management-Datenanalyse-Informatik. Auf Antrag an den Prüfungsausschuss können weitere Module zugelassen werden. Für die restlichen 20 LP aus der Mathematik können Vorlesungsmodule aus dem ganzen mathematischen Angebot des Modulhandbuchs gewählt werden.

Stochastik (8 LP)

Statistik	8 LP
Mathematische Statistik	4 LP
Asymptotische Stochastik	8 LP
Nichtparametrische Statistik	8 LP
Brownsche Bewegung	4 LP
Generalisierte Regressionsmodelle	4 LP
Perkolation	4 LP
Steuerung stochastischer Prozesse	4 LP
Zeitreihenanalyse	4 LP

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Angewandte u. Numerische Mathematik/Optimierung oder Analysis (8 LP)

Optimierung und optimale Kontrolle für Differentialgleichungen	4 LP
Paralleles Rechnen	5 LP
Numerische Optimierungsmethoden	8 LP
Steuerung stochastischer Prozesse	4 LP
Funktionalanalysis	8 LP
Variationsrechnung	8 LP
Klassische Methoden für partielle Differentialgleichungen	8 LP
Kontrolltheorie	4 LP
Optimierung in Banachräumen	8 LP
Spieltheorie	4 LP
Graphentheorie	8 LP
Modellbildung und numerische Simulation in der Praxis	4 LP

Finance - Risk Management - Managerial Economics (18 LP)

Finance 1	9 LP
Finance 2	9 LP
Finance 3	9 LP
Insurance Management I	9 LP
Mathematical and Empirical Finance	9 LP
Entscheidungs- und Spieltheorie	9 LP
Innovation und Wachstum	9 LP
Wachstum und Agglomeration	9 LP
Strategische Unternehmensführung und Organisation	9 LP
Microeconomic Theory	9 LP

Operations Management - Datenanalyse - Informatik (18 LP)

Informatik	9 LP
Methodische Grundlagen des OR	9 LP
Mathematische Optimierung	9 LP
Anwendungen des OR	9 LP
OR im Supply Chain Management und Health Care Management	9 LP
Stochastische Methoden und Simulation	9 LP
Stochastische Modellierung und Optimierung	9 LP
Energiewirtschaft und Technologie	9 LP
Marketing Management	9 LP

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Studienprofil Klassische Wirtschaftsmathematik

Im Studienprofil *Klassische Wirtschaftsmathematik* besteht die größte Freiheit bei der Wahl der Module. Einzelheiten des Angebots können dem Modulhandbuch entnommen werden.

4 Modulüberschneidungen und Pflichtbelegungen

Bei bestimmten Modulen ist die inhaltliche Überschneidung sehr groß. Daher gelten folgende Ausschlussregeln:

- Falls das Modul *Markov-Ketten* aus dem Bachelor Mathematik eingebracht wird, dann kann in den Modulen *Stochastische Methoden und Simulation* und *Stochastische Modellierung und Optimierung* keine der Veranstaltungen *Stochastische Entscheidungsmodelle I und II* eingebracht werden.
- Falls das Modul *Numerische Optimierungsmethoden* eingebracht wird, dann kann in den Modulen *Methodische Grundlagen des OR* und *Mathematische Optimierung* keine der Veranstaltungen *Nichtlineare Optimierung I und II* eingebracht werden.
- Falls das Modul *Spieltheorie* im Fach Mathematik eingebracht wird, dann kann in den Modulen *Entscheidungs- und Spieltheorie, Mathematische Optimierung*, *OR im Supply Chain Management und Health Care Management* und *Stochastische Modellierung und Optimierung* die Veranstaltung *Einführung in die Spieltheorie* nicht eingebracht werden.

Beim Einbringen des Moduls *Energiewirtschaft und Technologie* ist die Belegung der Vorlesung *Energiesystemanalyse* für den Studiengang Wirtschaftsmathematik verpflichtend.

Beim Einbringen des Moduls *Marketing Management* ist die Belegung der Vorlesungen *Produkt- und Innovationsmanagement* und *Marktforschung* für den Studiengang Wirtschaftsmathematik verpflichtend.

5 Schlüsselqualifikationen

Teil des Studiums ist auch der Erwerb von Schlüssel- und überfachlichen Qualifikationen. Zu diesem Bereich zählen überfachliche Veranstaltungen zu gesellschaftlichen Themen, fachwissenschaftliche Ergänzungsangebote, welche die Anwendung des Fachwissens im Arbeitsalltag vermitteln, Kompetenztrainings zur gezielten Schulung von Soft Skills sowie Fremdsprachentraining im fachwissenschaftlichen Kontext.

Der Masterstudiengang Wirtschaftsmathematik an den Fakultäten für Mathematik und Wirtschaftswissenschaften zeichnet sich durch einen außergewöhnlich hohen Grad an Interdisziplinarität aus. Mit der Kombination aus mathematischen und wirtschaftswissenschaftlichen Fächern ist die Zusammenführung von Wissensbeständen verschiedener Disziplinen integrativer Bestandteil des Studiengangs. Interdisziplinäres Denken in Zusammenhängen wird dabei in natürlicher Weise gefördert. Darüber hinaus tragen auch die Seminarveranstaltungen des Masterstudiengangs mit der Einübung wissenschaftlich hochqualifizierter Bearbeitung und Präsentation spezieller Themenbereiche wesentlich zur Förderung der Soft Skills bei. Die innerhalb des Studiengangs integrativ vermittelten Schlüsselkompetenzen lassen sich dabei den folgenden Bereichen zuordnen:

Basiskompetenzen (soft skills)

1. Teamarbeit, soziale Kommunikation und Kreativitätstechniken (z.B. Arbeit in Kleingruppen, gemeinsames Bearbeiten der Hausaufgaben und Nacharbeiten des Vorlesungsstoffes)
2. Präsentationserstellung und –techniken
3. Logisches und systematisches Argumentieren und Schreiben (z.B. in Übungen, Seminaren, beim Ausarbeiten der Vorträge und Verfassen der Hausaufgaben)
4. Strukturierte Problemlösung und Kommunikation

Praxisorientierung (enabling skills)

1. Handlungskompetenz im beruflichen Kontext
2. Kompetenzen im Projektmanagement
3. Betriebswirtschaftliche Grundkenntnisse
4. Englisch als Fachsprache

Orientierungswissen

1. Vermittlung von interdisziplinärem Wissen
2. Institutionelles Wissen über Wirtschafts- und Rechtssysteme
3. Wissen über internationale Organisationen
4. Medien, Technik und Innovation

Neben der integrativen Vermittlung von Schlüsselqualifikationen ist der additive Erwerb von Schlüsselqualifikationen im Umfang von mindestens drei Leistungspunkten vorgesehen. Lehrveranstaltungen, welche die nötigen Kompetenzen vermitteln, sind im Modul für Schlüsselqualifikationen zusammengefasst und werden regelmäßig in der entsprechenden Modulbeschreibung des Modulhandbuchs zum Masterstudiengang Wirtschaftsmathematik aktualisiert und im Internet bekannt gegeben. Diese Liste ist mit dem House of Competence abgestimmt.

2 Helpful information

Module Handbook

The programme exists of several **subjects** (e.g. business administration, economics, operations research). Every subject is split into **modules** and every module itself exists of one or more interrelated **courses**. 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 programme, 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 programme according to personal needs, interest and job perspective. The **module handbook** describes the modules belonging to the programme, their structure and extent (in CP), their dependencies, their learning outcomes, their learning control and examinations. Therefore it serves as a necessary orientation and as a helpful guide throughout the studies. The module handbook does not replace the **course catalogue**, which provides important information concerning each semester and variable course details (e.g. time and location of the course).

Begin and completion of a module

Every module and every course is allowed to be credited only once. The decision whether the course is assigned to one module or the other is made by the student at the time of signing in for the corresponding exam. The module is **succeeded**, if the general exam of the module and/or if all of its relevant partial exams have been passed (grade min 4.0).

General exams and partial exams

The module exam can be taken in a general exam or several partial exams. If the module exam is offered as a **general exam**, the entire content of the module will be reviewed in a single exam. If the module exam exists of **partial exams**, the content of each course will be reviewed in corresponding partial exams. The registration for the examinations in the bachelor programme takes place online via the self-service function for students. The following functions can be accessed on `https://studium.kit.edu` by means of the access information of the student card (FriCard):

- Sign in and sign off exams
- Retrieve examination results
- Print transcript of records

For students of the master programme the registration currently takes place at the **advisory service** of the faculty or at the respective institutes.

Repeating exams

Principally, a failed exam 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. Requests for a second repetition of an exam require the approval of the examination committee. A request for a second repetition has to be made without delay after loosing the examination claim.

Bonus accomplishments and additional accomplishments

Bonus accomplishments can be achieved on the basis of entire modules or within modules, if there are alternatives at choice. Bonus accomplishments can improve the module grade and overall grade by taking into account only the best possible combination of all courses when calculating the grades. The student has to declare a Bonus accomplishment as such at the time of registration for the exams. Exams, which have been registered as Bonus accomplishments, are subject to examination regulations. Therefore, a failed exam has to be repeated. Failing the repeat examination implies the loss of the examination claim.
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. Up to 2 modules with a minimum of 9

CP may appear additionally in the certificate. After the approval of the examination committee, it is also possible to include modules in the certificate, which are not defined in the module handbook. Single additional courses will be recorded in the transcript of records. Courses and modules, which have been declared as bonus accomplishments, can be changed to additional accomplishments.

Further information

More detailed information about the legal and general conditions of the programme can be found in the examination regulation of the programme.

Used abbreviations

LP/CP	Credit Points/ECTS	Leistungspunkte/ECTS
LV	course	Lehrveranstaltung
RÜ	computing lab	Rechnerübung
S	summer term	Sommersemester
Sem.	semester/term	Semester
SPO	examination regulations	Studien- und Prüfungsordnung
SQ	key qualifikation	Schlüsselqualifikationen
SWS	contact hour	Semesterwochenstunde
Ü	excercise course	Übung
V	lecture	Vorlesung
W	winter term	Wintersemester

3 Actual Changes

Important changes are pointed out in this section in order to provide a better orientation. Although this process was done with great care, other/minor changes may exist. Please also check our updates on http://www.wiwi.kit.edu/lehreMHB.php#mhb_aktuell.

MATHMWBWLFBV2 - Finance 2 (S. 110)

Anmerkungen

The course *eFinance: Information Engineering and Management for Securities Trading* [2540454] can be chosen from summer term 2015 on.

MATH4BWLFBV11 - Finance 3 (S. 111)

Anmerkungen

The course *eFinance: Information Engineering and Management for Securities Trading* [2540454] can be chosen from summer term 2015 on.

MATHMWUO1 - Strategic Corporate Management and Organization (S. 114)

Anmerkungen

The module will not be offered any more from summer term 2015. Students who are already assigned on the module can still finish it until summer term 2016.
The course "Organization Theory" will not be offered any more from summer term 2015 on. The examination will be offered latest until winter term 2015/2016 (repeaters only).
The credits for the courses "Managing Organizations" and "Management and Strategy" have been changed from 4 to 3,5 from summer term 2015 on.

MATHMWBWLMAR5 - Marketing Management (S. 115)

Anmerkungen

The course "Open Innovation – Concepts, Methods and Best Practices" [2571199] has been added summer 2015.
Please note that only one of the following courses can be chosen in the Marketing Management Module: Marketing Strategy Business Game, Strategic Brand Management, Open Innovation – Concepts, Methods and Best Practices or Business Plan Workshop.
For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).

MATHMW4VWL15 - Microeconomic Theory (S. 121)

Anmerkungen

Starting summer term 2015, the lecture "Auction Theory" [2590408] can be chosen in the module.

MATHMWSTAT1 - Mathematical and Empirical Finance (S. 124)

Anmerkungen

The course Portfolio and Asset Liability Management [2520357] will not be offered any more from summer term 2015 on. The examination will probably be offered latest until summer term 2014. Instead of this lecture Statistical Methods in Financial Risk Management [2521353] will be offered in winter term 2014/2015.

2577900 - Management and Strategy (S. 351)

Anmerkungen

The credits for the course "Management and Strategy" have been changed from 4 to 3,5 from summer term 2015 on.

2577902 - Managing Organizations (S. 273)

Anmerkungen

The credits for the course "Managing Organizations" have been changed from 4 to 3,5 from summer term 2015 on.

2577904 - Organization Theory (S. 274)

Anmerkungen

The course "Organization Theory" will not be offered any more from summer term 2015 on. The examination will be offered latest until winter term 2015/2016 (repeaters only).

2520375 - Data Mining (S. 175)

Anmerkungen

The credits for the course have been changed from 5 to 4,5 from summer term 2015 on.

2550491 - Seminar in Discrete Optimization (S. 306)

Erfolgskontrolle

The assessment consists of a written seminar thesis of 20-25 pages and a presentation of 35-40 minutes (according to §4(2), 3 of the examination regulation).
The final mark for the seminar consists of the seminar thesis, the seminar presentation, the handout, and if applicable further material such as programming code.
The seminar can be attended both by Bachelor and Master students. A differentiation will be achieved by different valuation standards for the seminar thesis and presentation.

2550495 - Operations Research in Health Care Management (S. 266)

Anmerkungen

The lecture (former name “Operations Research in Health Care Management”) is planned to be held in the summer term 2016.
The planned lectures and courses for the next three years are announced online.

2571199 - Open Innovation – Concepts, Methods and Best Practices (S. 265)

Anmerkungen

For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).
Please note that only one of the following courses can be chosen in the Marketing Management Module: Marketing Strategy Business Game, Strategic Brand Management, Open Innovation – Concepts, Methods and Best Practices or Business Plan Workshop.

4 Modules

4.1 Modules of Mathematics

Module: Differential Geometry [MATHMWAG04]

Coordination: W. Tuschmann
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
1036	Differential Geometry (p. 180)	4/2	W	8	S. Grensing , E. Leuzinger, G. Link, W. Tuschmann

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Qualification Goals

Content

Module: Algebra [MATHMWAG05]

Coordination: F. Herrlich
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
1031	Algebra (p. 155)	4/2	W	8	F. Herrlich, S. Kühnlein, C. Schmidt, G. Weitze-Schmithüsen

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Convex Geometry [MATHMWAG07]

Coordination: D. Hug
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
1044	Convex Geometry (p. 231)	4/2	W/S	8	D. Hug

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
It is recommended to attend the following modules previously:
Linear Algebra 1+2
Analysis 1-3

Qualification Goals
The students

- know fundamental combinatorial, geometric and analytic properties of convex sets and convex functions and apply these to related problems,
- are familiar with fundamental geometric and analytic inequalities for functionals of convex sets and their applications to geometric extremal problems and can present central ideas and techniques of proofs,
- know selected integral formulas for convex sets and the required results on invariant measures.
- know how to work self-organized and self-reflexive.

Content
1. Convex Sets
1.1. Combinatorial Properties
1.2. Support and Separation Properties
1.3. Extremal Representations
2. Convex Functions
2.1. Basic Properties
2.2. Regularity
2.3. Support Function
3. Brunn-Minkowski Theory
3.1. Hausdorff Metric
3.2. Volume and Surface Area
3.3. Mixed Volumes
3.4. Geometric Inequalities
3.5. Surface Area Measures
3.6. Projection Functions
4. Integralgeometric Formulas
4.1. Invariant Measures
4.2. Projection and Section Formulas

Module: Algebraic Number Theory [MATHMWAG09]

Coordination: C. Schmidt
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAG09	Algebraic Number Theory (p. 158)	4/2	W/S	8	F. Januszewski , S. Kühnlein, C. Schmidt

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Algebraic Geometry [MATHMWAG10]

Coordination: F. Herrlich
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAG10	Algebraic Geometry (p. 156)	4/2	W/S	8	F. Herrlich, S. Kühnlein, G. Weitze-Schmithüsen

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Geometry of Schemes [MATHMWAG11]

Coordination: F. Herrlich
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAG11	Geometry of Schemes (p. 208)	4/2	W/S	8	F. Herrlich, S. Kühnlein, G. Weitze-Schmithüsen

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Geometric Group Theory [MATHMWAG12]

Coordination: G. Weitze-Schmithüsen
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAG12	Geometric Group Theory (p. 209)	4/2	S	8	F. Herrlich, E. Leuzinger, R. Sauer, P. Schwer, G. Weitze-Schmithüsen

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Qualification Goals

Content

Module: Graph Theory [MATHAG26]

Coordination: M. Axenovich
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
GraphTH	Graph Theory (p. 216)	4+2	W/S	8	M. Axenovich

Learning Control / Examinations

Conditions
None.

Qualification Goals
Learning outcomes include: understanding structural and algorithmic properties of graphs, learning about graph colorings, unavoidable structures in graphs, probabilistic methods, properties of large graphs.

Content
The graph theory course covers the material starting with the basic graph properties introduced by Euler and finishing up with modern results and techniques in extremal graph theory. The specific topics include: structure of trees, paths, cycles, walks in graphs, unavoidable subgraphs in dense graphs, planar graphs, graph colorings, Ramsey theory, regularity in graphs.

Module: Global Differential Geometry [MATHAG27]

Coordination: W. Tuschmann
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAG27	Global Differential Geometry (p. 212)	4/2	W/S	8	S. Grensing , W. Tuschmann

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Qualification Goals

Content

Module: Combinatorics in the plane [MATHAG28]

Coordination: M. Axenovich
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry

ECTS Credits	Cycle	Duration
7	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAG28	Combinatorics in the plane (p. 229)	3/2	W/S	7	M. Axenovich, T. Ueckerdt

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Comparison Geometry [MATHAG30]

Coordination: W. Tuschmann
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry

ECTS Credits	Cycle	Duration
5	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAG30	Comparison Geometry (p. 355)	2/2	W/S	5	W. Tuschmann, M. Radeschi

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Sheaf cohomology in analysis and topology [MATHAG31]

Coordination: F. Herrlich
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry

ECTS Credits	Cycle	Duration
3	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAG31	Sheaf cohomology in analysis and topology (p. 204)	2	W/S	3	F. Herrlich, F. Januszewski , S. Kühnlein, G. Weitze-Schmithüsen

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Algebraic Topology [MATHAG34]

Coordination: R. Sauer
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAG34	Algebraic Topology (p. 157)	4/2	W/S	8	R. Sauer

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Introduction to geometric measure theory [MATHAG35]

Coordination: S. Winter
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry

ECTS Credits	Cycle	Duration
6	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAG35	Introduction to geometric measure theory (p. 141)	3/1	W/S	6	S. Winter

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Representation Theory of Finite Groups [MATHAG36]

Coordination: S. Kühnlein
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry

ECTS Credits	Cycle	Duration
4	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAG36	Representation Theory of Finite Groups (p. 174)	2/1	W/S	4	F. Januszewski , S. Kühnlein

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Combinatorics [MATHAG37]

Coordination: M. Axenovich
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry

ECTS Credits	**Cycle**	**Duration**
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAG37	Combinatorics (p. 228)	4/2	S	8	M. Axenovich, T. Ueckerdt

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Functional Analysis [MATHMWAN05]

Coordination: R. Schnaubelt
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
01048	(p. 202)	4/2	W	8	G. Herzog, D. Hundertmark, T. Lamm, M. Plum, W. Reichel, C. Schmoeger, R. Schnaubelt, L. Weis

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Recommendations
It is recommended to attend the following modules previously:
Linear Algebra 1+2
Analysis 1-3

Qualification Goals

Content

Module: Integral Equations [MATHMWAN07]

Coordination: F. Hettlich
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis, Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
IG	Integral Equations (p. 221)	4/2		8	T. Arens, F. Hettlich, A. Kirsch

Learning Control / Examinations

Conditions
None.

Recommendations
It is recommended to attend the following modules previously:
Linear Algebra 1+2
Analysis 1-3

Qualification Goals

Content

Module: Classical Methods for Partial Differential Equations [MATHMWAN08]

Coordination: M. Plum
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
KMPD	Classical Methods for Partial Differential Equations (p. 226)	4/2	W	8	D. Hundertmark, T. Lamm, M. Plum, W. Reichel, J. Rottmann-Matthes, R. Schnaubelt, L. Weis

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Boundary and eigenvalue problems [MATHMWAN09]

Coordination: W. Reichel
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
RUEP	Boundary and eigenvalue problems (p. 294)	4/2	S	8	D. Hundertmark, T. Lamm, M. Plum, W. Reichel, J. Rottmann-Matthes, R. Schnaubelt, L. Weis

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Spectral Theory [MATHMWAN10]

Coordination: L. Weis
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
SpekTheo	Spectral Theory (p. 322)	4/2	S	8	G. Herzog, C. Schmoeger, R. Schnaubelt, L. Weis

Learning Control / Examinations

Conditions
None.

Recommendations
It is recommended to attend the following modules previously:
Linear Algebra 1+2
Analysis 1-3
Functional Analysis or Differential Equations and Hilbert Spaces

Qualification Goals

Content

Module: Computer-Assisted Analytical Methods for Boundary and Eigenvalue Problems [MATHMWAN11]

Coordination: M. Plum
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN11	Computer-Assisted Analytical Methods for Boundary and Eigenvalue Problems (p. 171)	4/2	W/S	8	M. Plum

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Evolution Equations [MATHMWAN12]

Coordination: R. Schnaubelt
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN12	Evolution Equations (p. 194)	4/2	W/S	8	R. Schnaubelt, L. Weis

Learning Control / Examinations
exam:
written or oral exam after each semester
Marking:
grade of exam

Conditions
None.

Qualification Goals

Content

Module: Fourier Analysis [MATHMWAN14]

Coordination: L. Weis
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN14	Fourier Analysis (p. 201)	4/2	W/S	8	R. Schnaubelt, L. Weis

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

- Fourier series
- Fourier transform on L_1 and L_2
- Tempered distributions and their Fourier transform
- Explizit solutions of the Heat-, Schrödinger- and Wave equation in R^n
- the Hilbert transform
- the interpolation theorem of Marcinkiewicz
- Singular integral operators
- the Fourier multiplier theorem of Mihlin

Module: Complex Analysis II [MATHMWAN16]

Coordination: C. Schmoeger
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN16	Complex Analysis II (p. 203)	4/2	W/S	8	G. Herzog, M. Plum, W. Reichel, C. Schmoeger, R. Schnaubelt, L. Weis

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Qualification Goals

Content
- infinite products
- Mittag-Leffler theorem
- Montel's theorem
- Riemann mapping theorem
- conformal mappings
- univalent (schlicht) functions
- automorphisms of some domains
- harmonic functions
- Schwarz reflection principle
- regular and singular points of power series

Module: Control Theory [MATHAN18]

Coordination: R. Schnaubelt
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis

ECTS Credits	Cycle	Duration
6	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN18	Control Theory (p. 150)	3/1	W/S	6	R. Schnaubelt, L. Weis

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Potential Theory [MATHMWAN20]

Coordination: A. Kirsch
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis, Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN20	Potential Theory (p. 279)	4/2	W/S	8	T. Arens, F. Hettlich, A. Kirsch, W. Reichel

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Stochastic Differential Equations [MATHMWAN24]

Coordination: L. Weis
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN24	Stochastic Differential Equations (p. 337)	4/2	W/S	8	R. Schnaubelt, L. Weis

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Qualification Goals

Content

- Brownian motion
- Martingales and Martingal inequalities
- Stochastic integrals and Ito’s formula
- Existence and uniqueness of solutions for systems of stochastic differential equations
- Perturbation and stability results
- Application to equations in financial mathematics, physics and engineering
- Connection with diffusion equations and potential theory

Module: Calculus of variations [MATHMWAN25]

Coordination: W. Reichel
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN25	Calculus of variations (p. 353)	4/2	W/S	8	A. Kirsch, T. Lamm, M. Plum, W. Reichel

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Maxwell's Equations [MATHMWAN28]

Coordination: A. Kirsch
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis, Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN28	Maxwell's Equations (p. 245)	4/2	W/S	8	T. Arens, F. Hettlich, A. Kirsch

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Special functions and applications in potential theory [MATHAN33]

Coordination: A. Kirsch
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis, Applied and Numerical Mathematics

ECTS Credits	**Cycle**	**Duration**
5	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN33	Special functions and applications in potential theory (p. 329)	2/2	W/S	5	A. Kirsch

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Sobolev Spaces [MATHAN37]

Coordination: A. Kirsch
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis, Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
5	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN37	Sobolev Spaces (p. 316)	2/2	W/S	5	A. Kirsch

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Traveling Waves [MATHAN38]

Coordination: J. Rottmann-Matthes
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis

ECTS Credits	Cycle	Duration
6	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN38	Traveling Waves (p. 361)	3/1	W/S	6	J. Rottmann-Matthes

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Stochastic Evolution Equations [MATHAN40]

Coordination: L. Weis
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN40-1	Stochastic Evolution Equations (p. 340)	4	W/S	6	L. Weis
MATHAN40-2	Additional Topics on Stochastic Analysis (p. 193)	2	W/S	2	L. Weis

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Numerical methods for differential equations [MATHMWNM03]

Coordination: W. Dörfler, T. Jahnke
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
NMDG	Numerical methods for differential equations (p. 255)	4/2	W	8	W. Dörfler, M. Hochbruck, T. Jahnke, A. Rieder, C. Wieners

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Introduction to scientific computing [MATHMWNM05]

Coordination: W. Dörfler, T. Jahnke
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
EWR	Introduction to scientific computing (p. 185)	3/3	S	8	W. Dörfler, M. Hochbruck, T. Jahnke, A. Rieder, C. Wieners

Learning Control / Examinations
exam:
written or oral exam or practical
Marking:
grade of exam

Conditions
None.

Qualification Goals

Content

Module: Inverse Problems [MATHMWNM06]

Coordination: A. Kirsch
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
01052	Inverse Problems (p. 225)	4/2	W	8	T. Arens, F. Hettlich, A. Kirsch, A. Rieder

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Finite element methods [MATHMWNM07]

Coordination: W. Dörfler, C. Wieners
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM07	Finite Element Methods (p. 200)	4/2	W	8	W. Dörfler, M. Hochbruck, T. Jahnke, A. Rieder, C. Wieners

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Parallel computing [MATHMWNM08]

Coordination: C. Wieners
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
5	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM08	Parallel computing (p. 276)	2/2	W/S	5	C. Wieners

Learning Control / Examinations
prerequisite:
weekly work assignments in practice,
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Qualification Goals

Content

Module: Optimisation and optimal control for differential equations [MATHMWNM09]

Coordination: C. Wieners
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
4	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM09	Optimisation and optimal control for differential equations (p. 269)	2/1	W/S	4	W. Dörfler, M. Hochbruck, T. Jahnke, A. Rieder, C. Wieners

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Numerical Methods in Solid Mechanics [MATHMWNM12]

Coordination: C. Wieners
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
8	Once	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM12	Numerical Methods in Solid Mechanics (p. 260)	4+2	W/S	8	C. Wieners

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Numerical methods in computational electrodynamics [MATHMWNM13]

Coordination: W. Dörfler
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
6	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM13	Numerical methods in computational electrodynamics (p. 259)	3/1	W/S	6	W. Dörfler, M. Hochbruck, T. Jahnke, A. Rieder, C. Wieners

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Wavelets [MATHMWNM14]

Coordination: A. Rieder
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
Wave	Wavelets (p. 362)	4/2		8	A. Rieder

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Medical imaging [MATHMWNM15]

Coordination: A. Rieder
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM15	Medical imaging (p. 165)	4/2	W/S	8	A. Rieder

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Mathematical methods in signal and image processing [MATHMWNM16]

Coordination: A. Rieder
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM16	Mathematical methods in signal and image processing (p. 240)	4/2	W/S	8	A. Rieder

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Numerical Methods in Mathematical Finance [MATHMWNM18]

Coordination: T. Jahnke
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM18	Numerical Methods in Mathematical Finance (p. 261)	4/2	W/S	8	T. Jahnke

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Adaptive finite elemente methods [MATHMWNM19]

Coordination: W. Dörfler
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
6	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM19	Adaptive finite elemente methods (p. 151)	3/1	W/S	6	W. Dörfler

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Numerical methods for time-dependent partial differential equations [MATHMWNM20]

Coordination: M. Hochbruck
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM20	Numerical methods for time-dependent partial differential equations (p. 258)	4/2	W/S	8	M. Hochbruck, T. Jahnke

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Numerical optimisation methods [MATHMWNM25]

Coordination: C. Wieners
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM25	Numerical optimisation methods (p. 263)	4/2	W/S	8	W. Dörfler, M. Hochbruck, T. Jahnke, A. Rieder, C. Wieners

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Numerical methods in mathematical finance II [MATHNM26]

Coordination: T. Jahnke
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM26	Numerical methods in mathematical finance II (p. 262)	4/2	W/S	8	T. Jahnke

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Mathematical modelling und simulation in practise [MATHNM27]

Coordination: G. Thäter
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
4	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM27	Mathematical modelling und simulation in practise (p. 241)	2/1	W/S	4	G. Thäter

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Numerical Methods for Integral Equations [MATHNM29]

Coordination: T. Arens
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM29	Numerical Methods for Integral Equations (p. 257)	4/2	W/S	8	T. Arens, F. Hettlich, A. Kirsch

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Numerical methods for hyperbolic equations [MATHNM28]

Coordination: W. Dörfler
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
6	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM28	Numerical methods for hyperbolic equations (p. 256)	3/1	W/S	6	W. Dörfler

Learning Control / Examinations

Conditions
None.

Qualification Goals
.

Content

Module: Special topics in numerical linear algebra [MATHNM30]

Coordination: M. Hochbruck
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM30	Special topics in numerical linear algebra (p. 148)	4/2	W/S	8	M. Hochbruck

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Geometric numerical integration [MATHNM31]

Coordination: T. Jahnke
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
6	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM31	Geometric numerical integration (p. 210)	3/1	W/S	6	M. Hochbruck, T. Jahnke

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Optimization in Banach spaces [MATHNM32]

Coordination: A. Kirsch
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Analysis, Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM32	Optimization in Banach spaces (p. 144)	4/2	W/S	8	A. Kirsch

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Numerical methods for Maxwell's equations [MATHNM33]

Coordination: T. Jahnke
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
6	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM33	Numerical methods for Maxwell's equations (p. 264)	3/1	W/S	6	T. Jahnke

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Numerical methods in fluid mechanics [MATHNM34]

Coordination: W. Dörfler, G. Thäter
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
4	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM34	Numerical methods in fluid mechanics (p. 143)	2/1	W/S	4	W. Dörfler, G. Thäter

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Compressive Sensing [MATHNM37]

Coordination: A. Rieder
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
3	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM37	Compressive Sensing (p. 145)	2	W/S	3	A. Rieder

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Functions of operators [MATHNM38]

Coordination: V. Grimm
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
6	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM38	Functions of operators (p. 147)	3/1	W/S	6	V. Grimm

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Functions of matrices [MATHNM39]

Coordination: V. Grimm
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM39	Functions of matrices (p. 244)	4/2	W/S	8	V. Grimm

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Project centered Software-Lab [MATHNM40]

Coordination: G. Thäter
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
4	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM40	Project centered Software-Lab (p. 289)	4	W/S	4	G. Thäter

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

Module: Introduction into particulate flows [MATHNM41]

Coordination: W. Dörfler
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
3	Once	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM41	Introduction into particulate flows (p. 142)	2	W	3	W. Dörfler

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Numerical continuation methods [MATHNM42]

Coordination: J. Rottmann-Matthes
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	Cycle	Duration
5	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM42	Numerical continuation methods (p. 254)	2/2	W/S	5	J. Rottmann-Matthes

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Introduction to Matlab and numerical algorithms [MATHNM43]

Coordination: D. Weiß
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Applied and Numerical Mathematics

ECTS Credits	**Cycle**	**Duration**
5	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM43	Introduction to Matlab and numerical algorithms (p. 186)	2/2	W/S	5	D. Weiß, C. Wieners

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Discrete time finance [MATHST04]

Coordination: N. Bäuerle
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
FMDZ	Discrete time finance (p. 198)	4/2	W	8	N. Bäuerle, V. Fasen

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Qualification Goals

Content

Module: Statistics [MATHWMST05]

Coordination: B. Klar
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
Stat	Statistics (p. 333)	4/2	W	8	N. Henze, B. Klar

Learning Control / Examinations
exam: written or oral exam
Marking: grade of exam

Conditions
None.

Qualification Goals

Content

Module: Stochastic Geometry [MATHMWST06]

Coordination: D. Hug
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Algebra/Geometry, Stochastics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST06	Stochastic Geometry (p. 341)	4/2	W/S	8	D. Hug, G. Last

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
It is recommended to attend the following modules previously:
Probability Theory
Convex Geometry or Spatial Stochastics

Qualification Goals
The students

- know the fundamental geometric models and characteristics in stochastic geometry,
- are familiar with properties of Poisson processes of geometric objects,
- know examples of applications of models of stochastic geometry,
- know how to work self-organised and self-reflexive.

Content

- Random Sets
- Geometric Point Processes
- Stationarity and Isotropy
- Germ Grain Models
- Boolean Models
- Foundations of Integral Geometry
- Geometric densities and characteristics
- Random Tessellations

Module: Asymptotic Stochastics [MATHMWST07]

Coordination: N. Henze
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST07	Asymptotic Stochastics (p. 163)	4/2	W	8	V. Fasen, N. Henze, B. Klar

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Qualification Goals

Content

Module: Continuous time finance [MATHMWST08]

Coordination: N. Bäuerle
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST08	Mathematical Finance in Continuous Time (p. 199)	4/2	S	8	N. Bäuerle, V. Fasen

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Generalized Regression Models [MATHMWST09]

Coordination: B. Klar
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST09	Generalized Regression Models (p. 207)	2/1	W	4	N. Henze, B. Klar

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Qualification Goals

Content

Module: Brownian Motion [MATHMWST10]

Coordination: N. Bäuerle
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

ECTS Credits	Cycle	Duration
4	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST10	Brownian Motion (p. 167)	2/1	W/S	4	N. Bäuerle, V. Fasen, N. Henze, G. Last

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Qualification Goals

Content

Module: Markov Decision Processes [MATHMWST11]

Coordination: N. Bäuerle
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

ECTS Credits	Cycle	Duration
5	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST11	Markov Decision Processes (p. 237)	2/2	W/S	5	N. Bäuerle

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Qualification Goals

Content

Module: Stochastic Control [MATHMWST12]

Coordination: N. Bäuerle
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

ECTS Credits	Cycle	Duration
4	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST12	Stochastic Control (p. 334)	2/1	W/S	4	N. Bäuerle

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Percolation [MATHMWST13]

Coordination: G. Last
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

ECTS Credits	Cycle	Duration
4	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST13	Percolation (p. 278)	2/1	W/S	4	G. Last

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
It is recommended to attend the following modules previously:
Probability Theory

Qualification Goals
The students

- are acquainted with basic models of discrete and continuum percolation,
- acquire the skills needed to use specific probabilistic and graph-theoretical methods for the analysis of these models,
- know how to work self-organised and self-reflexive.

Content

- Bond and site percolation on graphs
- Harris-Kesten theorem
- Asymptotics of the cluster size in the subcritical and the supercritical case
- Continuum percolation
- Uniqueness of the infinite cluster in the quasi transitive case
- Percolation on the Gilbert graph
- Voronoi percolation

Module: Spatial Stochastics [MATHMWST14]

Coordination: G. Last
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST14	Spatial Stochastics (p. 293)	4/2	W/S	8	D. Hug, G. Last

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
It is recommended to attend the following modules previously:
Probability Theory

Qualification Goals
The students are familiar with some basic spatial stochastic processes. They do not only understand how to deal with general properties of distributions, but also know how to describe and apply specific models (Poisson process, Gaussian random fields). They know how to work self-organised and self-reflexive.

Content

- Point processes
- Random measures
- Poisson processes
- Gibbs point processes
- Ralm distributions
- Spatial ergodic theorem
- Spectral Theory of random fields
- Gaussian fields

Module: Mathematical Statistics [MATHMWST15]

Coordination: B. Klar
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

ECTS Credits	Cycle	Duration
4	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST15	Mathematical Statistics (p. 242)	2/1	W/S	4	N. Henze, B. Klar

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Nonparametric Statistics [MATHMWST16]

Coordination: N. Henze
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST16	Nonparametric Statistics (p. 253)	4/2	W/S	8	N. Henze, B. Klar

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Time Series Analysis [MATHMWST18]

Coordination: B. Klar
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST18	Time Series Analysis (p. 365)	2/1	S	4	N. Henze, B. Klar

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Poisson processes [MATHST20]

Coordination: G. Last
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

ECTS Credits	Cycle	Duration
5	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST20	Poisson processes (p. 178)	2/2	W/S	5	V. Fasen, D. Hug, G. Last

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Qualification Goals
The students know about important properties of the Poisson process. The focus is on probabilistic methods and results which are independent of the specific phase space. The students understand the central role of the Poisson process as a specific point process and as a random measure.

Content

- Distributional properties of Poisson processes
- The Poisson process as a particular point process
- stationary Poisson and point processes
- Random measures and Cox processes
- Poisson cluster processes and compound Poisson processes
- The spatial Gale-Shapley algorithm

Module: Extreme value theory [MATHST23]

Coordination: V. Fasen
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

ECTS Credits	Cycle	Duration
4	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST23	Extreme value theory (p. 146)	2/1	W/S	4	V. Fasen, N. Henze

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Stein's Method [MATHST24]

Coordination: M. Schulte
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

ECTS Credits	Cycle	Duration
5	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST24	Stein's Method (p. 149)	2/2	W/S	5	M. Schulte

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Forecasting: Theory and Practice I [MATHST25]

Coordination: T. Gneiting
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

ECTS Credits	Cycle	Duration
3	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST25	Forecasting: Theory and Practice I (p. 357)	2	W/S	3	T. Gneiting

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Forecasting: Theory and Practice II [MATHST26]

Coordination: T. Gneiting
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

ECTS Credits	**Cycle**	**Duration**
3	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST26	Forecasting: Theory and Practice II (p. 358)	2	W/S	3	T. Gneiting

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Probability theory and combinatorial optimization [MATHST27]

Coordination: D. Hug
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Stochastics

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST27	Probability theory and combinatorial optimization (p. 360)	4/2	W/S	8	D. Hug, G. Last

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Seminar [MATHMWSE01]

Coordination: Studiendekan/Studiendekanin
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Seminar

ECTS Credits	Cycle	Duration
3	Every term	1

Learning Control / Examinations

Conditions

None.

Qualification Goals

Content

4.2 Modules of Economics and Business Engineering

Module: Finance 1 [MATHMWBWLFBV1]

Coordination: M. Uhrig-Homburg, M. Ruckes
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Finance - Risk Management - Managerial Economics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2530550	Derivatives (p. 179)	2/1	S	4,5	M. Uhrig-Homburg
2530212	Valuation (p. 352)	2/1	W	4,5	M. Ruckes
2530555	Asset Pricing (p. 162)	2/1	S	4,5	M. Uhrig-Homburg, M. Ruckes

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module seperately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
None.

Qualification Goals
The student

- has core skills in economics and methodology in the field of finance
- assesses corporate investment projects from a financial perspective
- is able to make appropriate investment decisions on financial markets

Content
The courses of this module equip the students with core skills in economics and methodology in the field of modern finance. Securities which are traded on financial and derivative markets are presented, and frequently applied trading strategies are discussed. A further focus of this module is on the assessment of both profits and risks in security portfolios and corporate investment projects from a financial perspective.

Module: Finance 2 [MATHMWBWLFBV2]

Coordination: M. Uhrig-Homburg, M. Ruckes
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Finance - Risk Management - Managerial Economics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2530260	Fixed Income Securities (p. 196)	2/1	W	4,5	M. Uhrig-Homburg
2530214	Corporate Financial Policy (p. 172)	2/1	S	4,5	M. Ruckes
2530240	Market Microstructure (p. 239)	2/0	W	3	T. Lüdecke
2530565	Credit Risk (p. 233)	2/1	W	4,5	M. Uhrig-Homburg
2530210	Cost and Management Accounting (p. 224)	2/1	S	4,5	T. Lüdecke
2530555	Asset Pricing (p. 162)	2/1	S	4,5	M. Uhrig-Homburg, M. Ruckes
2530212	Valuation (p. 352)	2/1	W	4,5	M. Ruckes
2530550	Derivatives (p. 179)	2/1	S	4,5	M. Uhrig-Homburg
2530570	International Finance (p. 222)	2	S	3	M. Uhrig-Homburg, Dr. Walter
2530299	Business Strategies of Banks (p. 211)	2	W	3	W. Müller
2530296	Exchanges (p. 166)	1	S	1,5	J. Franke
2530232	Financial Intermediation (p. 197)	3	W	4,5	M. Ruckes
2540454	eFinance: Information Engineering and Management for Securities Trading (p. 184)	2/1	W	4,5	C. Weinhardt

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module seperately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
It is only possible to choose this module in combination with the module *Finance 1* [MATHMWBWLFBV1]. The module is passed only after the final partial exam of *Finance 1* is additionally passed.
The courses *Asset Pricing* [VLAP], *Valuation* [2530212] and *Derivatives* [2530550] can only be chosen if they have not been chosen in the module *Finance 1* [MATHMWBWLFBV1] already.

Qualification Goals
The student is in a position to discuss, analyze and provide answers to advanced economic and methodological issues in the field of modern finance.

Content
The module Finance 2 is based on the module Finance 1. The courses of this module equip the students with advanced skills in economics and methodology in the field of modern finance on a broad basis.

Remarks
The course *eFinance: Information Engineering and Management for Securities Trading* [2540454] can be chosen from summer term 2015 on.

Module: Finance 3 [MATH4BWLFBV11]

Coordination: M. Uhrig-Homburg, M. Ruckes
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Finance - Risk Management - Managerial Economics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2530555	Asset Pricing (p. 162)	2/1	S	4,5	M. Uhrig-Homburg, M. Ruckes
2530212	Valuation (p. 352)	2/1	W	4,5	M. Ruckes
2530550	Derivatives (p. 179)	2/1	S	4,5	M. Uhrig-Homburg
2530260	Fixed Income Securities (p. 196)	2/1	W	4,5	M. Uhrig-Homburg
2530565	Credit Risk (p. 233)	2/1	W	4,5	M. Uhrig-Homburg
2530214	Corporate Financial Policy (p. 172)	2/1	S	4,5	M. Ruckes
2530240	Market Microstructure (p. 239)	2/0	W	3	T. Lüdecke
2530210	Cost and Management Accounting (p. 224)	2/1	S	4,5	T. Lüdecke
2530232	Financial Intermediation (p. 197)	3	W	4,5	M. Ruckes
2530296	Exchanges (p. 166)	1	S	1,5	J. Franke
2530299	Business Strategies of Banks (p. 211)	2	W	3	W. Müller
2530570	International Finance (p. 222)	2	S	3	M. Uhrig-Homburg, Dr. Walter
2540454	eFinance: Information Engineering and Management for Securities Trading (p. 184)	2/1	W	4,5	C. Weinhardt

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module seperately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
It is only possible to choose this module in combination with the module *Finance 1* [MATHMWBWLFBV1] and *Finance 2* [MATHMWBWLFBV2]. The module is passed only after the final partial exams of *F1(Finance) and F2 (Finance)* are additionally passed.
The courses *Asset Pricing* [VLAP], *Valuation* [2530212] and *Derivatives* [2530550] can only be chosen if they have not been chosen in the module *Finance 1* [MATHMWBWLFBV1] or *Finance 2* [MATHMWBWLFBV2] already.

Qualification Goals
The student is in a position to discuss, analyze and provide answers to advanced economic and methodological issues in the field of modern finance.

Content
The courses of this module equip the students with advanced skills in economics and methodology in the field of modern finance on a broad basis.

Remarks
The course *eFinance: Information Engineering and Management for Securities Trading* [2540454] can be chosen from summer term 2015 on.

Module: Insurance Management I [MATHMWBWLFBV6]

Coordination: U. Werner
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Finance - Risk Management - Managerial Economics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2550055	Principles of Insurance Management (p. 285)	3/0	S	4,5	U. Werner
2530323	Insurance Marketing (p. 218)	3/0	S	4,5	E. Schwake
2530324	Insurance Production (p. 219)	3/0	W/S	4,5	U. Werner
2530050	Private and Social Insurance (p. 286)	2/0	W	2,5	W. Heilmann, K. Besserer
2530350	Current Issues in the Insurance Industry (p. 173)	2/0	S	2	W. Heilmann
2530335	Insurance Risk Management (p. 220)	2/0	S	2,5	H. Maser
INSGAME	P&C Insurance Simulation Game (p. 275)	3	W	3	U. Werner
2530395	Risk Communication (p. 295)	3/0	W/S	4,5	U. Werner
2530355	Modelling, Measuring and Managing of Extreme Risks (p. 248)	2	S	2,5	U. Werner, S. Hochrainer

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2) of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
None.

Qualification Goals
See German version.

Content
See German version.

Module: Energy Economics and Technology [MATHMWBWLIIP5]

Coordination: W. Fichtner
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Operations Management - Data Analysis - Informatics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2581003	Energy and Environment (p. 188)	2/1	S	4,5	U. Karl, n.n.
2581958	Strategical Aspects of Energy Economy (p. 343)	2/0	W	3,5	A. Ardone
2581000	Technological Change in Energy Economics (p. 348)	2/0	W	3	M. Wietschel
2581001	Heat Economy (p. 359)	2/0	S	3	W. Fichtner
2581002	Energy Systems Analysis (p. 189)	2/0	W	3	V. Bertsch
2581006	Efficient Energy Systems and Electric Mobility (p. 182)	2/0	S	3,5	R. McKenna, P. Jochem

Learning Control / Examinations
The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The examinations take place every semester. Re-examinations are offered at every ordinary examination date.The assessment procedures are described for each course of the module seperately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal. Additional courses might be accredited upon request.

Conditions
To integrate the module "Energy Economics and Technology" in the degree programme "Wirtschaftsmathematik" it is compulsory to choose the course „Energy Systems Analysis".

Recommendations
The courses are conceived in a way that they can be attended independently from each other. Therefore, it is possible to start the module in winter and summer term.

Qualification Goals
The student

- gains detailed knowledge about present and future energy supply technologies (focus on final energy carriers electricity and heat),
- knows the techno-economic characteristics of plants for energy provision, for energy transport as well as for energy distribution and demand,
- is able to assess the environmental impact of these technologies.

Content
Strategical Aspects of Energy Economy: Long-term planning methods, generation technologies
Technological Change in Energy Economics: Future energy technologies, learning curves, energy demand
Heat Economy: district heating, heating technologies, reduction of heat demand, statutory provisions
Energy Systems Analysis: Interdependencies in energy economics, energy systems modelling approaches in energy economics
Energy and Environment: emission factors, emission reduction measures, environmental impact
Efficient Energy Systems and Electric Mobility: concepts and current trends in energy efficiency, Overview of and economical, ecological and social impacts through electric mobility

Module: Strategic Corporate Management and Organization [MATHMWUO1]

Coordination: H. Lindstädt
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Finance - Risk Management - Managerial Economics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2577904	Organization Theory (p. 274)	2	W	4,5	H. Lindstädt
2577902	Managing Organizations (p. 273)	2/0	W	3.5	H. Lindstädt
2577908	Modeling Strategic Decision Making (p. 246)	2	S	4,5	H. Lindstädt
2577900	Management and Strategy (p. 351)	2/0	S	3.5	H. Lindstädt
2577910	Problem solving, communication and leadership (p. 287)	1/0	S	2	H. Lindstädt

Learning Control / Examinations
The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The examinations are offered every semester. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module seperately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
None.

Qualification Goals
See German version.

Content
The module emphasizes the following aspects: The students learn models and frameworks which are used in strategic management and managing organizations. In addition, the module provides knowledge about management concepts and their practical application.
The module addresses three focal points: First, the students will learn models, frameworks and theoretical findings of the economic organization theory. Further, questions of a value-based concern leadership are discussed. Finally, the limitations of the basic models of economic decision theory are identified and advanced concepts are developed.

Remarks
The module will not be offered any more from summer term 2015. Students who are already assigned on the module can still finish it until summer term 2016.
The course “Organization Theory” will not be offered any more from summer term 2015 on. The examination will be offered latest until winter term 2015/2016 (repeaters only).
The credits for the courses “Managing Organizations” and “Management and Strategy” have been changed from 4 to 3,5 from summer term 2015 on.

Module: Marketing Management [MATHMWBWLMAR5]

Coordination: M. Klarmann
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Operations Management - Data Analysis - Informatics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2571154	Product and Innovation Marketing (p. 288)	2/0	S	3	M. Klarmann
2571150	Market Research (p. 238)	2/1	S	4,5	M. Klarmann
2572167	Behavioral Approaches in Marketing (p. 356)	2/1	W	4,5	B. Neibecker
2571165	Strategic and Innovative Decision Making in Marketing (p. 344)	2/1	S	4,5	B. Neibecker
2572184	Business Plan Workshop (p. 168)	1	S	3	M. Klarmann, O. Terzidis
2571176	Marketing Strategy Business Game (p. 236)	1	S	1,5	M. Klarmann, Mitarbeiter
2571185	Strategic Brand Management (p. 342)	1/0	S	1,5	M. Klarmann, J. Blickhäuser
2571199	Open Innovation – Concepts, Methods and Best Practices (p. 265)	1/0	S	1,5	A. Hahn

Learning Control / Examinations

The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO) of the courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions

See german version.

Qualification Goals

Students
- have an advanced knowledge about central marketing contents
- have a fundamental understanding of the marketing instruments
- know and understand several strategic concepts and how to implement them
- are able to implement their extensive marketing knowledge in a practical context
- know several qualitative and quantitative approaches to prepare decisions in Marketing
- have the theoretical knowledge to write a master thesis in Marketing
- have the theoretical knowledge to work in/together with the Marketing department

Content

The aim of this module is to deepen central marketing contents in different areas. Therefore the students can choose between the following marketing courses:

- "Product and Innovation Marketing"
- "Market Research" – this course has to be completed successfully by students interested in seminar or master thesis positions at the chair of marketing
- "Strategic and Behavioral Marketing"
- "Strategic and Innovative Decision Making in Marketing"
- "Business Plan Workshop"
- "Marketing and Strategy Business Game"

Remarks

The course "Open Innovation – Concepts, Methods and Best Practices" [2571199] has been added summer 2015.

Please note that only one of the following courses can be chosen in the Marketing Management Module: Marketing Strategy Business Game, Strategic Brand Management, Open Innovation – Concepts, Methods and Best Practices or Business Plan Workshop.
For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).

Module: Innovation and growth [MATHMWVWLIWW1]

Coordination: I. Ott
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Finance - Risk Management - Managerial Economics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2520543	Theory of Economic Growth (p. 349)	2/1	S	4,5	M. Hillebrand
2560236	Innovationtheory and -policy (p. 217)	2/1	S	4,5	I. Ott
2561503	Theory of endogenous growth (p. 187)	2/1	W	4,5	I. Ott

Learning Control / Examinations
The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The exams are offered at the beginning of the recess period about the subject matter of the latest held lecture. Re-examinations are offerd at every ordinary examination date. The assessment procedures are described for each course of the module seperately.
The overall grade for the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
None.

Recommendations
Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012], and Economics II [2600014]. In addition, an interest in quantitative-mathematical modeling is required.

Qualification Goals
Students shall be given the ability to

- know the basic techniques for analyzing static and dynamic optimization models that are applied in the context of micro- and macroeconomic theories
- understand the important role of innovation to the overall economic growth and welfare
- identify the importance of alternative incentive mechanisms for the emergence and dissemination of innovations
- explain, in which situations market interventions by the state, for example taxes and subsidies, can be legitimized, and evaluate them in the light of economic welfare

Content
The module includes courses that deal with issues of innovation and growth in the context of micro-and macroeconomic theories. The dynamic analysis makes it possible to analyze the consequences of individual decisions over time, and sheds light on the tension between static and dynamic efficiency in particular. In this context is also analyzed, which policy is appropriate to carry out corrective interventions in the market and thus increase welfare in the presence of market failure.

Module: Decision and Game Theory [MATHMWVWL10]

Coordination: C. Puppe
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Finance - Risk Management - Managerial Economics

ECTS Credits	Cycle	Duration
9		

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2520365	Decision Theory (p. 191)	2/1	S	4,5	K. Ehrhart
2590408	Auction Theory (p. 164)	2/1	W	4.5	K. Ehrhart
2540489	Experimental Economics (p. 195)	2/1	W	4,5	C. Weinhardt, T. Teubner
2521533	Advanced Game Theory (p. 153)	2/1	W	4,5	P. Reiss, C. Puppe, K. Ehrhart

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module seperately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
None.

Qualification Goals
The student learns the basics of individual and strategic decisions on an advanced and formal level.
He learns to analyze economic problems through abstract and method-based thinking and to design solution strategies. In the tutorials, the concepts and results of the lecture will be applied in case studies.

Content

Module: Growth and Agglomeration [MATHMWVWL12]

Coordination: I. Ott
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Finance - Risk Management - Managerial Economics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2561503	Theory of endogenous growth (p. 187)	2/1	W	4,5	I. Ott
2561260 / 2561261	Spatial Economics (p. 321)	2/1	W	4,5	I. Ott
2560254	International Economic Policy (p. 223)	2/1	S	4,5	J. Kowalski

Learning Control / Examinations
The assessment is carried out as partial written exams (see the lectures descriptions).
The overall grade for the module is the average of the grades for each course weighted by the credits.

Conditions
Successful completion of the courses *Economics I: Microeconomics* [2600012] and *Economics II: Macroeconomics* [2600014] is required.

Recommendations
Attendance of the course *Introduction Economic Policy* [2560280] is recommended.

Qualification Goals
The student

- gains deepened knowledge of micro-based general equilibrium models
- understands how based on individual optimizing decisions aggregate phenomena like economic growth or agglomeration (cities / metropolises) result
- is able to understand and evaluate the contribution of these phenomena to the development of economic trends
- can derive policy recommendations based on theory

Content
The module includes the contents of the lectures *Endogenous Growth Theory* [2561503], *Spatial Economics* [2561260] and *International Economic Policy* [2560254]. While the first two lectures have a more formal-analytic focus, the third lecture approaches fundamental ideas and problems from the field of international economic policy from a more verbal perspective.
The common underlying principle of all three lectures in this module is that, based on different theoretical models, economic policy recommendations are derived.

Module: Economic Theory and its Application in Finance [MATHMW4VWL14]

Coordination: K. Mitusch
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Finance - Risk Management - Managerial Economics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2520527	Advanced Topics in Economic Theory (p. 154)	2/1	S	4,5	M. Hillebrand, K. Mitusch
2530214	Corporate Financial Policy (p. 172)	2/1	S	4,5	M. Ruckes
2530232	Financial Intermediation (p. 197)	3	W	4,5	M. Ruckes
2530555	Asset Pricing (p. 162)	2/1	S	4,5	M. Uhrig-Homburg, M. Ruckes

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The exams are offered at the beginning of the recess period about the subject matter of the latest held lecture. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately. The overall grade for the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
The course „Advanced Topics in Economic Theory“ is compulsory and must be examined.
The module can be chosen in the following study profiles:

- Financial Engineering & Actuarial Sciences
- Classical business mathematics

Recommendations
None.

Qualification Goals
The students

- have learnt the methods of formal economic modeling, particularly of General Equilibrium Theory and contract theory
- will be able to apply these methods to the topics in Finance, specifically the areas of financial markets and institutions and corporate finance
- have gained many useful insights into the relationship between firms and investors and the functioning of financial markets

Content
The mandatory course „Advanced Topics in Economic Theory“ is devoted in equal parts to General Equilibrium Theory and to contract theory. The course „Asset Pricing“ will apply techniques of General Equilibrium Theory to valuation of financial assets. The courses „Corporate Financial Policy” and „Finanzintermediation“ will apply the techniques of contract theory to issues of corporate finance and financial institutions.

Module: Microeconomic Theory [MATHMW4VWL15]

Coordination: C. Puppe
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Finance - Risk Management - Managerial Economics

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2521533	Advanced Game Theory (p. 153)	2/1	W	4,5	P. Reiss, C. Puppe, K. Ehrhart
2520527	Advanced Topics in Economic Theory (p. 154)	2/1	S	4,5	M. Hillebrand, K. Mitusch
2520537	Social Choice Theory (p. 317)	2/1	S	4,5	C. Puppe
2590408	Auction Theory (p. 164)	2/1	W	4.5	K. Ehrhart

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module seperately.
The overall grade of the the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
The module can be chosen in the following profiles:

- Operations Research
- Classical business mathematics

Recommendations
None.

Qualification Goals
Students

- are able to model practical microoeconomic problems mathematically and to analyze them with respect to positive and normative questions,
- understand individual incentives and social outcomes of different institutional designs.

An example of a positive question is: which regulation policy results in which firm decistions under imperfect competition? An example of a normative question is: which voting rule has appealing properties?

Content
The student should gain an understanding of advanced topics in economic theory, game theory and welfare economics. Core topics are, among others, strategic interactions in markets, cooperative and non-cooperative bargaining (Advanced Game Theory), allocation under asymmetric information and general equilibrium over time (Advanced Topics in Economic Theory), voting and the aggregation of preferences and judgements (Social Choice Theory).

Remarks
Starting summer term 2015, the lecture “Auction Theory” [2590408] can be chosen in the module.

Module: Collective Decision Making [MATHMW4VWL16]

Coordination: C. Puppe
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Finance - Risk Management - Managerial Economics

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
25539	Mathematical Theory of Democracy (p. 243)	2/1	W	4,5	A. Melik-Tangyan
2520537	Social Choice Theory (p. 317)	2/1	S	4,5	C. Puppe
2561127	Public Management (p. 290)	2	W	4,5	B. Wigger, Assistenten

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module seperately.
The overall grade of the the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
The module can be chosen in the following profiles:

- Classical business mathematics

Recommendations
None.

Qualification Goals
Students

- are able to model practical problems of the public sector and to analyze them with respect to positive and normative questions,
- understand individual incentives and social outcomes of different institutional designs,
- are familiar with the functioning and design of democratic elections and can analyze them with respect to their individual incentives.

Content
The focus of the module is on mechanisms of public decisions making, including voting and the aggregation of preferences and judgements.

Module: Experimental Economics [MATHMW4VWL17]

Coordination: P. Reiss
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Finance - Risk Management - Managerial Economics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2540489	Experimental Economics (p. 195)	2/1	W	4,5	C. Weinhardt, T. Teubner
2520402/ 2520403	Predictive Mechanism and Market Design (p. 284)	2/1	W	4,5	P. Reiss
n.n.	Topics in Experimental Economics (p. 350)	2/1	S	4,5	P. Reiss

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO) of the core course and further single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

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

Conditions
The course *Experimental Economics* [2540489] is compulsory and must be examined.
The module can be chosen in the following profiles:

- Classical business mathematics

Recommendations
Basic knowledge in mathematics, statistics, and game theory is assumed.

Qualification Goals
Students

- are acquainted with the methods of Experimental Economics along with its strengths and weaknesses;
- understand how theory-guided research in Experimental Economics interacts with the development of theory;
- are provided with foundations in data analysis;
- design an economic experiment and analyze its outcome.

Content
The module Experimental Economics offers an introduction into the methods and topics of Experimental Economics. It also fosters and extends knowledge in theory-guided experimental economics and its interaction with theory development. Throughout the module, readings of selected papers are required.

Remarks

- The course *Advanced Game Theory* is not offered before Winter 2014/15.
- The course *Predictive Mechanism and Market Design* is not offered each year.

Module: Mathematical and Empirical Finance [MATHMWSTAT1]

Coordination: W. Heller
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Finance - Risk Management - Managerial Economics

ECTS Credits	Cycle	Duration
9	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2521331	Stochastic Calculus and Finance (p. 336)	2/1	W	5	W. Heller, M. Safarian
2520381	Advanced Econometrics of Financial Markets (p. 152)	2/1	S	5	A. Nazemi
2521353	Statistical Methods in Financial Risk Management (p. 331)	2/1		5	A. Nazemi

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module seperately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
None.

Qualification Goals
See German version.

Content

Remarks
The course Portfolio and Asset Liability Management [2520357] will not be offered any more from summer term 2015 on. The examination will probably be offered latest until summer term 2014. Instead of this lecture Statistical Methods in Financial Risk Management [2521353] will be offered in winter term 2014/2015.

Module: Statistical Methods in Risk Management [MATHMW4STAT2]

Coordination: W. Heller
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Finance - Risk Management - Managerial Economics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2520337	Stochastic and Econometric Models in Credit Risk Management (p. 335)	2/2	S	5	Y. Kim
2520375	Data Mining (p. 175)	2	W/S	4,5	G. Nakhaeizadeh
2520317	Multivariate Methods (p. 249)	2/2	S	5	W. Heller
2521353	Statistical Methods in Financial Risk Management (p. 331)	2/1		5	A. Nazemi
2521325/2521326	Statistics and Econometrics in Business and Economics (p. 332)	2/2	W	4,5	W. Heller

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module seperately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
The module can be chosen in the following profiles:

- Classical business mathematics

Qualification Goals
See German version.

Content

Module: Applications of Operations Research [MATHMWOR5]

Coordination: S. Nickel
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Operations Management - Data Analysis - Informatics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2550486	Facility Location and Strategic Supply Chain Management (p. 330)	2/1	W	4,5	S. Nickel
2550488	Tactical and Operational Supply Chain Management (p. 347)	2/1	S	4,5	S. Nickel
2550490	Software Laboratory: OR Models I (p. 318)	1/2	W	4,5	S. Nickel
2550134	Global Optimization I (p. 213)	2/1	W	4,5	O. Stein
2550662	Simulation I (p. 313)	2/1/2	W/S	4,5	K. Waldmann

Learning Control / Examinations
The assessment is carried out as partial exams (according to § 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module.
The assessment procedures are described for each course of the module seperately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
The module can be chosen in the following profiles:

- Operations Research
- Classical business mathematics

At least one of the courses *Facility Location and strategic Supply Chain Management* [2550486] and *Tactical and operational Supply Chain Management* [2550488] has to be taken.

Qualification Goals
The student

- is familiar with basic concepts and terms of Supply Chain Management,
- knows the different areas of Supply Chain Management and their respective optimization problems,
- is acquainted with classical location problem models (in the plane, on networks and discrete) as well as fundamental methods for distribution and transport planning, inventory planning and management,
- is able to model practical problems mathematically and estimate their complexity as well as choose and adapt appropriate solution methods.

Content
Supply Chain Management is concerned with the planning and optimization of the entire, inter-company procurement, production and distribution process for several products taking place between different business partners (suppliers, logistics service providers, dealers). The main goal is to minimize the overall costs while taking into account several constraints including the satisfaction of customer demands.
This module considers several areas of Supply Chain Management. On the one hand, the determination of optimal locations within a supply chain is addressed. Strategic decisions concerning the location of facilities like production plants, distribution centers or warehouses are of high importance for the rentability of supply chains. Thoroughly carried out, location planning tasks allow an efficient flow of materials and lead to lower costs and increased customer service. On the other hand, the planning of material transport in the context of Supply Chain Management represents another focus of this module. By linking transport connections and different facilities, the material source (production plant) is connected with the material sink (customer). For given material flows or shipments, it is considered how to choose the optimal (in terms of minimal costs) distribution and transportation chain from the set of possible logistics chains, which asserts the compliance of delivery times and further constraints.

Furthermore, this module offers the possibility to learn about different aspects of the tactical and operational planning level in Suppy Chain Management, including methods of scheduling as well as different approaches in procurement and distribution logistics. Finally, issues of warehousing and inventory management will be discussed.

Remarks
The planned lectures and courses for the next three years are announced online.

Module: Methodical Foundations of OR [MATHMWOR6]

Coordination: O. Stein
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Operations Management - Data Analysis - Informatics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2550111	Nonlinear Optimization I (p. 251)	2/1	S	4,5	O. Stein
2550113	Nonlinear Optimization II (p. 252)	2/1	S	4,5	O. Stein
2550134	Global Optimization I (p. 213)	2/1	W	4,5	O. Stein
2550136	Global Optimization II (p. 214)	2/1	W	4,5	O. Stein
2550486	Facility Location and Strategic Supply Chain Management (p. 330)	2/1	W	4,5	S. Nickel
2550679	Markov Decision Models I (p. 338)	2/1/2	W	5	K. Waldmann

Learning Control / Examinations
The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module seperately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
At least one of the lectures *Nonlinear Optimization I* [2550111] and *Global Optimization I* [2550134] has to be examined.

Qualification Goals
The student

- names and describes basic notions for optimization methods, in particular from nonlinear and from global optimization,
- knows the indispensable methods and models for quantitative analysis,
- models and classifies optimization problems and chooses the appropriate solution methods to solve also challenging optimization problems independently and, if necessary, with the aid of a computer,
- validates, illustrates and interprets the obtained solutions.

Content
The modul focuses on theoretical foundations as well as solution algorithms for optimization problems with continuous decision variables. The lectures on nonlinear programming deal with local solution concepts, whereas the lectures on global optimization treat approaches for global solutions.

Remarks
The planned lectures and courses for the next three years are announced online (http://www.ior.kit.edu).
For the lectures of Prof. Stein a grade of 30 % of the exercise course has to be fulfilled. The description of the particular lectures is more detailed.

Module: Stochastic Methods and Simulation [MATHMWOR7]

Coordination: K. Waldmann
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Operations Management - Data Analysis - Informatics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2550679	Markov Decision Models I (p. 338)	2/1/2	W	5	K. Waldmann
2550682	Markov Decision Models II (p. 339)	2/1/2	S	4,5	K. Waldmann
2550662	Simulation I (p. 313)	2/1/2	W/S	4,5	K. Waldmann
2550665	Simulation II (p. 314)	2/1/2	W/S	4,5	K. Waldmann
2550111	Nonlinear Optimization I (p. 251)	2/1	S	4,5	O. Stein
2550488	Tactical and Operational Supply Chain Management (p. 347)	2/1	S	4,5	S. Nickel

Learning Control / Examinations
The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module seperately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
The module can be chosen in the following study profiles:

-
- Financial Engineering & Actuarial Sciences
- Operations Research
- Classical Economathematics

At least one of the courses Markov Decision Models [2550679] or Simulation I [2550662] has to be attended.
The course Markov Decision Models I [2550679] can only be chosen if the module Markov chains [MATHBAST03] has not been chosen in Bachelor Mathematics (B.Sc.) already.

Qualification Goals
The student posses profound knowledge in modelling, analyzing and optimizing stochastic systems in economy and engineering.

Content
Markov Decision Models I: Markov Chains, Poisson Processes
Markov Decision Models II: Queuing Systems, Stochastic Decision Processes
Simulation I: Generation of random numbers, Monte Carlo integration, Discrete event simulation, Discrete and continuous random variables, Statistical analysis of simulated data.
Simulation II: Variance reduction techniques, Simulation of stochastic processes, Case studies.

Remarks
The planned lectures and courses for the next two years are announced online (http://www.ior.kit.edu/).

Module: Operations Research in Supply Chain Management and Health Care Management [MATHMWOR8]

Coordination: S. Nickel
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Operations Management - Data Analysis - Informatics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2550486	Facility Location and Strategic Supply Chain Management (p. 330)	2/1	W	4,5	S. Nickel
2550488	Tactical and Operational Supply Chain Management (p. 347)	2/1	S	4,5	S. Nickel
2550480	Operations Research in Supply Chain Management (p. 267)	2/1	W/S	4,5	S. Nickel
2550495	Operations Research in Health Care Management (p. 266)	2/1	W/S	4,5	S. Nickel
2550493	Hospital Management (p. 232)	2/0	W/S	3	S. Nickel, Hansis
2550498	Practical seminar: Health Care Management (with Case Studies) (p. 283)	2/1/2	W/S	7	S. Nickel
2550497	Software Laboratory: OR Models II (p. 319)	2/1	S	4,5	S. Nickel
2550488	Discrete-event Simulation in Production and Logistics (p. 192)	2/1	S	4,5	S. Nickel, S. Spieckermann
2550494	Supply Chain Management in the Process Industry (p. 346)	2/1	W	4,5	S. Nickel
2550484	Graph Theory and Advanced Location Models (p. 215)	2/1	W/S	4,5	S. Nickel
n.n.	Challenges in Supply Chain Management (p. 169)	3	S	4,5	R. Blackburn

Learning Control / Examinations
The assessment is carried out as partial exams (according to § 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module.
The assessment procedures are described for each course of the module seperately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
See German version.

Recommendations
Basic knowledge as conveyed in the module *Introduction to Operations Research* [WI1OR] is assumed.

Qualification Goals
The student

- is familiar with basic concepts and terms of Supply Chain Management,
- knows the different areas of SCM and their respective optimization problems,
- is acquainted with classical location problem models (in planes, in networks and discrete) as well as fundamental methods for distribution and transport planning, inventory planning and management,
- is familiar with general procedures and characteristics of Health Care Management and the possibilities for adapting mathematical models for non-profit organizations,
- is able to model practical problems mathematically and estimate their complexity as well as choose and adapt appropriate solution methods.

Content
Supply Chain Management is concerned with the planning and optimization of the entire, inter-company procurement, production and distribution process for several products taking place between different business partners (suppliers, logistics service providers, dealers). The main goal is to minimize the overall costs while taking into account several constraints including the satisfaction of customer demands.
This module considers several areas of SCM. On the one hand, the determination of optimal locations within a supply chain is addressed. Strategic decisions concerning the location of facilities as production plants, distribution centers or warehouses are of high importance for the rentability of Supply Chains. Thoroughly carried out, location planning tasks allow an efficient flow of materials and lead to lower costs and increased customer service. On the other hand, the planning of material transport in the context of supply chain management represents another focus of this module. By linking transport connections and different facilities, the material source (production plant) is connected with the material sink (customer). For given material flows or shipments, it is considered how to choose the optimal (in terms of minimal costs) distribution and transportation chain from the set of possible logistics chains, which asserts the compliance of delivery times and further constraints. Furthermore, this module offers the possibility to learn about different aspects of the tactical and operational planning level in Suppy Chain Mangement, including methods of scheduling as well as different approaches in procurement and distribution logistics. Finally, issues of warehousing and inventory management will be discussed.
Health Care Management addresses specific Supply Chain Management problems in the health sector. Important applications arise in scheduling and internal logistics of hospitals.

Remarks
Some lectures and courses are offered irregularly.
The planned lectures and courses for the next three years are announced online.

Module: Mathematical Programming [MATHMWOR9]

Coordination: O. Stein
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Operations Management - Data Analysis - Informatics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
25138	Mixed Integer Programming I (p. 205)	2/1	S	4,5	O. Stein
25140	Mixed Integer Programming II (p. 206)	2/1	W	4,5	O. Stein
2550128	Special Topics in Optimization I (p. 327)	2/1	W/S	4,5	O. Stein
2550126	Special Topics in Optimization II (p. 328)	2/1	W/S	4,5	O. Stein
2550484	Graph Theory and Advanced Location Models (p. 215)	2/1	W/S	4,5	S. Nickel
2550111	Nonlinear Optimization I (p. 251)	2/1	S	4,5	O. Stein
2550113	Nonlinear Optimization II (p. 252)	2/1	S	4,5	O. Stein
2550134	Global Optimization I (p. 213)	2/1	W	4,5	O. Stein
2550136	Global Optimization II (p. 214)	2/1	W	4,5	O. Stein
2550120	Convex Analysis (p. 230)	2/1		4,5	O. Stein
2550115	Parametric Optimization (p. 277)	2/1		4,5	O. Stein

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module seperately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
See German version.

Qualification Goals
The student

- names and describes basic notions for advanced optimization methods, in particular from continuous and mixed integer programming, location theory, and graph theory,
- knows the indispensable methods and models for quantitative analysis,
- models and classifies optimization problems and chooses the appropriate solution methods to solve also challenging optimization problems independently and, if necessary, with the aid of a computer,
- validates, illustrates and interprets the obtained solutions,
- identifies drawbacks of the solution methods and, if necessary, is able to makes suggestions to adapt them to practical problems.

Content
The modul focuses on theoretical foundations as well as solution algorithms for optimization problems with continuous and mixed integer decision variables, for location problems and for problems on graphs.

Remarks
The lectures are partly offered irregularly. The curriculum of the next three years is available online (www.ior.kit.edu).
For the lectures of Prof. Stein a grade of 30 % of the exercise course has to be fulfilled. The description of the particular lectures is more detailed.

Module: Stochastic Modelling and Optimization [MATHMWOR10]

Coordination: K. Waldmann
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Operations Management - Data Analysis - Informatics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2550679	Markov Decision Models I (p. 338)	2/1/2	W	5	K. Waldmann
2550682	Markov Decision Models II (p. 339)	2/1/2	S	4,5	K. Waldmann
2550674	Quality Control I (p. 291)	2/1/2	W/S	4,5	K. Waldmann
25659	Quality Control II (p. 292)	2/1/2	W/S	4,5	K. Waldmann
25687	Optimization in a Random Environment (p. 268)	2/1/2	W/S	4,5	K. Waldmann
2550662	Simulation I (p. 313)	2/1/2	W/S	4,5	K. Waldmann
2550665	Simulation II (p. 314)	2/1/2	W/S	4,5	K. Waldmann
25688	OR-oriented modeling and analysis of real problems (project) (p. 270)	2/1/2	W/S	4,5	K. Waldmann

Learning Control / Examinations
The assessment is carried out as partial written exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module seperately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
See German version.

Qualification Goals
The student posses detailed knowledge in modelling, analyzing and optimizing stochastic systems in economy and engineering.

Content
Markov Decision Models I: Markov Chains, Poisson Processes.
Markov Decision Models II: Queuing Systems, Stochastic Decision Processes
Simulation I: Generation of random numbers, Monte Carlo integration, Discrete event simulation, Discrete and continuous random variables, Statistical analysis of simulated data.
Simulation II: Variance reduction techniques, Simulation of stochastic processes, Case studies.
Quality Control I: Statistical Process Control, Acceptance Sampling, Design of experiments
Quality Control II: Reliability of complexe systems with and without repair, Maintenance
OR-orientied modeling and analysis of real problems: project-based modelling and analysis

Remarks
The planned lectures and courses for the next two years are announced online (http://www.ior.kit.edu/).

Module: Informatics [MATHMWINFO1]

Coordination: H. Schmeck, A. Oberweis, R. Studer
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Operations Management - Data Analysis - Informatics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2511102	Algorithms for Internet Applications (p. 159)	2/1	W	5	H. Schmeck
2511032	Applied Informatics II - IT Systems for e-Commerce (p. 161)	2/1/1	S	4	J. Zöllner, N.N.
2511202	Database Systems and XML (p. 177)	2/1	W	5	A. Oberweis
2511212	Document Management and Groupware Systems (p. 181)	2	S	4	S. Klink
2511100	Efficient Algorithms (p. 183)	2/1	S	5	H. Schmeck
2511600	Enterprise Architecture Management (p. 190)	2/1	W	5	T. Wolf
2511404	IT Complexity in Practice (p. 235)	2/1	W	5	D. Seese, Kreidler
2511302	Knowledge Discovery (p. 227)	2/1	W	5	R. Studer
2511214	Management of IT-Projects (p. 234)	2/1	S	5	R. Schätzle
2511210	Business Process Modelling (p. 247)	2/1	W	5	A. Oberweis
2511106	Nature-inspired Optimisation Methods (p. 250)	2/1	S	5	P. Shukla
2511104	Organic Computing (p. 271)	2/1	S	5	H. Schmeck, S. Mostaghim
2590458	Computational Economics (p. 170)	2/1	W	4,5	P. Shukla, S. Caton
2511216	Capability maturity models for software and systems engineering (p. 354)	2	S	4	R. Kneuper
2511308	Service Oriented Computing 2 (p. 312)	2/1	S	5	R. Studer, S. Agarwal, B. Norton
2511208	Software Quality Management (p. 320)	2/1	S	5	A. Oberweis
25700sp	Special Topics of Efficient Algorithms (p. 324)	2/1	W/S	5	H. Schmeck
SBI	Special Topics of Enterprise Information Systems (p. 323)	2/1	W/S	5	A. Oberweis
SSEsp	Special Topics of Software- and Systemsengineering (p. 325)	2/1	W/S	5	A. Oberweis
25860sem	Special Topics of Knowledge Management (p. 326)	2/1	W/S	5	R. Studer
2511602	Strategic Management of Information Technology (p. 345)	2/1	S	5	T. Wolf
2511204	Workflow-Management (p. 364)	2/1	S	5	A. Oberweis
25810	Practical Seminar Knowledge Discovery (p. 311)	2	S	4	R. Studer
PraBI	Computing Lab Information Systems (p. 280)	2	W/S	4	A. Oberweis, R. Studer
25700p	Advanced Lab in Efficient Algorithms (p. 281)	3	W/S	4	H. Schmeck
25740p	Exercises in Knowlegde Management (p. 282)	3	W/S	4	R. Studer
2511218	Requirements Analysis and Requirements Management (p. 160)	2/0	W	4	R. Kneuper
2511310	Semantic Web Technologies (p. 296)	2/1	S	5	R. Studer, A. Harth
2199118	Smart Energy Distribution (p. 315)	2	S	4	H. Schmeck

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2) of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. For passing the module exam in every singled partial exam the respective minimum requirements has to be achieved.
The examinations are offered every semester. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately.
When every singled examination is passed, the overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
It is only allowed to choose one lab.

Qualification Goals
The student

- has the ability to master methods and tools in a complex discipline and to demonstrate innovativeness regarding the methods used,
- knows the principles and methods in the context of their application in practice,
- is able to grasp and apply the rapid developments in the field of computer science, which are encountered in work life, quickly and correctly, based on a fundamental understanding of the concepts and methods of computer science,
- is capable of finding and defending arguments for solving problems.

Content
The thematic focus will be based on the choice of courses in the areas of Effiziente Algorithmen, Betriebliche Informations- und Kommunikationssysteme, Wissensmanagement, Komplexitätsmanagement and Software- und Systems Engineering.

Module: Seminar [MATHMWSEM02]

Coordination: O. Stein
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Finance - Risk Management - Managerial Economics

ECTS Credits	Cycle	Duration
3		

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2530280	Seminar in Finance (p. 299)	2	W/S	3	M. Uhrig-Homburg, M. Ruckes
SemFBV1	Seminar Risk and Insurance Management (p. 302)	2	W/S	3	U. Werner
2577915	Seminar: Management and Organization (p. 310)	2	W/S	3	H. Lindstädt
SemWIOR3	Seminar in Experimental Economics (p. 307)	2	W/S	3	N. N.
SemWIOR2	Seminar Economic Theory (p. 363)	2	W/S	3	C. Puppe
SemIWW3	Seminar in Economic Policy (p. 301)	2	W/S	3	I. Ott
SemETS3	Seminar on Macroeconomic Theory (p. 309)	2		3	M. Hillebrand
2530353	Seminar Financial Economics and Risk Management (p. 300)	2	W/S	3	M. Ulrich

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Seminar [MATHMWSEM03]

Coordination: O. Stein
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Operations Management - Data Analysis - Informatics

ECTS Credits	Cycle	Duration
3		

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
SemAIFB1	Seminar in Enterprise Information Systems (p. 297)	2	W/S	4	R. Studer, A. Oberweis, T. Wolf, R. Kneuper
SemAIFB2	Seminar Efficient Algorithms (p. 298)	2	W/S	3	H. Schmeck
SemAIFB4	Seminar Knowledge Management (p. 305)	2	W	4	R. Studer
2595470	Seminar Service Science, Management & Engineering (p. 303)	2	W/S	4	C. Weinhardt, R. Studer, S. Nickel, H. Fromm, W. Fichtner, G. Satzger
2550131	Seminar in Continous Optimization (p. 308)	2	W/S	3	O. Stein
2550491	Seminar in Discrete Optimization (p. 306)	2	W/S	3	S. Nickel
SemWIOR1	Seminar Stochastic Models (p. 304)	2	W/S	3	K. Waldmann

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

4.3 General Modules

Module: Internship [MATHBERP]

Coordination: O. Stein, Studiendekan/Studiendekanin
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field:

ECTS Credits	Cycle	Duration
8	Every term	1

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: [MATHWMSQ01]

Coordination: Studiendekan/Studiendekanin
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field: Key Competences

ECTS Credits	Cycle	Duration
3-4		

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

Module: Master Thesis [WMATHMAST]

Coordination: Studiendekan/Studiendekanin
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject/Field:

ECTS Credits	Cycle	Duration
30	Every term	

Learning Control / Examinations

Conditions
None.

Qualification Goals

Content

5 Courses

5.1 All Courses

Course: Introduction to geometric measure theory [MATHAG35]

Coordinators: S. Winter
Part of the modules: Introduction to geometric measure theory (p. 36)[MATHAG35]

ECTS Credits	Hours per week	Term	Instruction language
6	3/1	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Introduction into particulate flows [MATHNM41]

Coordinators: W. Dörfler
Part of the modules: Introduction into particulate flows (p. 85)[MATHNM41]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Numerical methods in fluid mechanics [MATHNM34]

Coordinators: W. Dörfler, G. Thäter
Part of the modules: Numerical methods in fluid mechanics (p. 80)[MATHNM34]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Optimization in Banach spaces [MATHNM32]

Coordinators: A. Kirsch
Part of the modules: Optimization in Banach spaces (p. 78)[MATHNM32]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Compressive Sensing [MATHNM37]

Coordinators: A. Rieder
Part of the modules: Compressive Sensing (p. 81)[MATHNM37]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Extreme value theory [MATHST23]

Coordinators: V. Fasen, N. Henze
Part of the modules: Extreme value theory (p. 103)[MATHST23]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Functions of operators [MATHNM38]

Coordinators: V. Grimm
Part of the modules: Functions of operators (p. 82)[MATHNM38]

ECTS Credits	Hours per week	Term	Instruction language
6	3/1	Winter / Summer Term	

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Special topics in numerical linear algebra [MATHNM30]

Coordinators: M. Hochbruck
Part of the modules: Special topics in numerical linear algebra (p. 76)[MATHNM30]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Stein's Method [MATHST24]

Coordinators: M. Schulte
Part of the modules: Stein's Method (p. 104)[MATHST24]

ECTS Credits	Hours per week	Term	Instruction language
5	2/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Control Theory [MATHAN18]

Coordinators: R. Schnaubelt, L. Weis
Part of the modules: Control Theory (p. 48)[MATHAN18]

ECTS Credits	Hours per week	Term	Instruction language
6	3/1	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Adaptive finite elemente methods [MATHNM19]

Coordinators: W. Dörfler
Part of the modules: Adaptive finite elemente methods (p. 69)[MATHMWNM19]

ECTS Credits	Hours per week	Term	Instruction language
6	3/1	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Advanced Econometrics of Financial Markets [2520381]

Coordinators: A. Nazemi
Part of the modules: Mathematical and Empirical Finance (p. 124)[MATHMWSTAT1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Summer term	en

Learning Control / Examinations
The assessment of this course consists of a written examination (following §4(2), 1 SPO) and of possible additional assignments during the course (following §4(2), 3 SPO).

Conditions
None.

Learning Outcomes
After successful completion of the course students will have attained both knowledge and competency to comprehend the theories behind portfolio management of major financial institutions. Hence students can adapt this understanding to the more specialised needs of the intermediary.

Content
Advanced Econometrics of Financial Markets covers: Forecasting stock return, market microstructure(non-synchronised trading, spread and modelling transactions), “event studies analysis”, capital asset pricing model, multi-factor price models, intertemporal equilibrium models.

Media
transparencies, exercises.

Basic literature
Campbell, Lo, McKinlay: The Econometrics of Financial Markets. Princeton University Press.

Remarks
See German version.

Course: Advanced Game Theory [2521533]

Coordinators: P. Reiss, C. Puppe, K. Ehrhart
Part of the modules: Decision and Game Theory (p. 118)[MATHMWVWL10], Microeconomic Theory (p. 121)[MATHMW4VWL15]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	en

Learning Control / Examinations
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Recommendations
Basic knowledge of mathematics and statistics is assumed.

Learning Outcomes
The student
- deepens and broadens his/her basic knowledge of Game Theory,
- develops a rigorous understanding of newer concepts in Game Theory,
- develops the capability to independently model and analyze complex systems of strategic decision-making, and to develop appropriate solutions.

Content
This course offers an advanced and rigorous treatment of game theory.

Media
Slides, problem sets.

Basic literature
Compulsory textbook:
Osborne, M. A. Rubinstein, A Course in Game Theory, MIT Press, 1994.
Additional Literature:
Aumann, R./Hart, S. (Hrsgb.), Handbook of Game Theory I-III, Elsevier, 1992/1994/2002.

Course: Advanced Topics in Economic Theory [2520527]

Coordinators: M. Hillebrand, K. Mitusch
Part of the modules: Economic Theory and its Application in Finance (p. 120)[MATHMW4VWL14], Microeconomic Theory (p. 121)[MATHMW4VWL15]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	en

Learning Control / Examinations
The assessment consists of a written exam (60min) (following §4(2), 1 of the examination regulation) at the beginning of the recess period or at the beginning of the following semester.

Conditions
None.

Recommendations
This course is designed for advanced Master students with a strong interest in economic theory and mathematical models. Bachelor students who would like to participate are free to do so, but should be aware that the level is much more advanced than in other courses of their curriculum.

Learning Outcomes
The students

- will understand fundamental questions of General Equilibrium Theory and will be able to solve these questions with appropriate methods,
- will understand fundamental questions of information economics respectively contract theory and will be able to solve these questions with appropriate methods,
- will be able to apply advanced methods of formal economic modelling.

Content
The course deals with basic elements of modern economic theory. It is divided into two parts. The first part introduces the microeconomic foundations of general equilibrium á la Debreu ("The Theory of Value", 1959) and Hildenbrand/Kirman ("Equilibrium Analysis",1988). The second part deals with asymmetric information and introduces the basic techniques of contract theory.
The course is largely based on the textbook "Microeconomic Theory" (Chapters 1-5, 10, 13-20) by A.Mas-Colell, M.D.Whinston, and J.R.Green.

Basic literature
The course is based on the excellent textbook "Microeconomic Theory" (Chapters 1-5, 10, 13-20) by A.Mas-Colell, M.D.Whinston, and J.R.Green.

Remarks
The course Advanced Topics in Economic Theory will not take place in summer semester 2015.

Course: Algebra [1031]

Coordinators: F. Herrlich, S. Kühnlein, C. Schmidt, G. Weitze-Schmithüsen
Part of the modules: Algebra (p. 24)[MATHMWAG05]

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

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Learning Outcomes

Content

Course: Algebraic Geometry [MATHAG10]

Coordinators: F. Herrlich, S. Kühnlein, G. Weitze-Schmithüsen
Part of the modules: Algebraic Geometry (p. 27)[MATHMWAG10]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Algebraic Topology [MATHAG34]

Coordinators: R. Sauer
Part of the modules: Algebraic Topology (p. 35)[MATHAG34]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Algebraic Number Theory [MATHAG09]

Coordinators: F. Januszewski , S. Kühnlein, C. Schmidt
Part of the modules: Algebraic Number Theory (p. 26)[MATHMWAG09]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Algorithms for Internet Applications [2511102]

Coordinators: H. Schmeck
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Winter term	en

Learning Control / Examinations
The assessment consists of a written exam (60 min) (according to Section 4(2), 1 of the examination regulation) and an additional written examination (called "bonus exam", 45 min) (according Section 4(2), 3 of the examination regulation).
The grade of this course is the achieved grade in the written examination. If this grade is at least 4.0 and at most 1.3, a passed bonus exam will improve it by one grade level (i.e. by 0.3 or 0.4).

Conditions
None.

Learning Outcomes
The students will learn to master methods and concepts of essential algorithms within Internet applications and to develop capabilities for innovative improvements. The course aims at teaching advanced concepts for the design and application of algorithms with respect to the requirements in networked systems. Based on a fundamental understanding of taught concepts and methods the students should be able to select appropriate concepts and methods for problem settings in their future professional life, and - if necessary - customize and apply them in an adequate way. The students will be capable to find appropriate arguments for their chosen approach to a problem setting.
In particular, the student will

- know the structure and elementary protocols of the Internet (TCP/IP) and standard routing algorithms (distance vector and link state routing),
- know methods of information retrieval in the WWW, algorithms for searching information and be able to assess the performance of search engines,
- know how to design and use cryptographic methods and protocols to guarantee and check confidentiality, data integrity and authenticity,
- know algorithmic basics of electronic payment systems and of electronic money.

Content
Internet and World Wide Web are changing our world, this core course provides the necessary background and methods for the design of central applications of the Internet. After an introduction into Internet technology the following topics are addressed: information retrieval in the www, structure and functioning of search engines, foundations of secure communication, electronic payment systems and digital money, and - if time permits - security architectures.

Media
Powerpoint slides with annotations on graphics screen, access to Internet resources, recorded lectures

Basic literature

- Tanenbaum: Computer Networks, 4th edition, Prentice-Hall 2003.
- Baeza-Yates, Ribeiro-Neto: Modern Information Retrieval. Addison-Wesley, 1999.
- Wobst: Abenteuer Kryptologie : Methoden, Risiken und Nutzen der Datenverschlüsselung, 3rd edition. Addison-Wesley, 2001.
- Schneier: Applied Cryptography, John Wiley, 1996.
- Furche, Wrightson: Computer money : Zahlungssysteme im Internet [Übers.: Monika Hartmann]. - 1. Aufl. - Heidelberg : dpunkt, Verl. für Digitale Technologie, 1997.

Elective literature:

- Further references will be given in the course.

Course: Requirements Analysis and Requirements Management [2511218]

Coordinators: R. Kneuper
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
4	2/0	Winter term	de

Learning Control / Examinations
The assessment of this course is a written or (if necessary) oral examination according to §4(2) of the examination regulation.

Conditions
None.

Learning Outcomes
The students have a full understanding of the foundations of the analysis and management of requirements as part of the development process of software and systems. They know the main terminology and approaches of this topic, and are able to express requirements themselves using different description methods.

Content
The analysis and management of requirements is a central task in the development of software and systems, addressing the border between the application discipline and computer science. The adequate performance of this task has a decisive influence on the whether or not a development project will be successful. The lecture provides an introduction to this topic, using the syllabus for the “Certified Professional for Requirements Engineering” (CPRE) as a guideline.
Lecture structure:
1. Introduction and overview, motivation
2. Identifying requirements
3. Documenting requirements (in natural language or using a modelling language such as UML)
4. Verification and validation of requirements
5. Management of requirements
6. Tool support

Basic literature
Literature will be given in the lecture.

Course: Applied Informatics II - IT Systems for e-Commerce [2511032]

Coordinators: J. Zöllner, N.N.
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1/1	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (120 min) according to Section 4(2), 1 of the examination regulation.
The successful completion of the compulsory exercises is prerequisite for the admission to the written exam.
The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Recommendations
Knowledge of content of the module [WI1INFO].

Learning Outcomes
The student learns about concepts and technologies for designing big, distributed application architectures. Students apply industry-relevant technology to solve application-oriented problems in lab classes.

Content
The course Applied Informatics II [2511032] covers various facets of electronic commerce which have to be supported by adequate and efficient distributed information systems. Key topics are middleware technologies and distributed application architectures. Document description and exchange (incl. XML), Java EE, Web technologies, and Web services are additional topics.

Media
Slides, internet resources.

Basic literature
Tba in the lecture.

Course: Asset Pricing [2530555]

Coordinators: M. Uhrig-Homburg, M. Ruckes
Part of the modules: Finance 2 (p. 110)[MATHMWBWLFBV2], Economic Theory and its Application in Finance (p. 120)[MATHMW4VWL14], Finance 1 (p. 109)[MATHMWBWLFBV1], Finance 3 (p. 111)[MATH4BWLFBV11]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	de

Learning Control / Examinations

Conditions
None.

Recommendations
We strongly recommend knowledge of the basic topics in investments (bachelor course), which will be necessary to be able to follow the course.

Learning Outcomes
Students are familiar with advanced concepts in asset pricing (in particular the stochastic discount factor model). They are able to apply their acquired skills to solve empirical questions related to securities.

Content
This lecture deals with the valuation of risky cash flows. A stochastic discount model and a central equation will be introduced, which form the basis of nearly every valuation model in finance. That includes the valuation of stocks, bonds and derivatives. The first part of the lecture will present the theory, the second part covers empirical questions related to this approach.

Basic literature
Basic literature

- Asset pricing / Cochrane, J.H. - Rev. ed., Princeton Univ. Press, 2005.

Elective literature

- Investments and Portfolio Management / Bodie, Z., Kane, A., Marcus, A.J. - 9. ed., McGraw-Hill, 2011.
- The econometrics of financial markets / Campbell, J.Y., Lo, A.W., MacKinlay, A.C. - 2. printing, with corrections, Princeton Univ. Press, 1997.

Course: Asymptotic Stochastics [MATHST07]

Coordinators: V. Fasen, N. Henze, B. Klar
Part of the modules: Asymptotic Stochastics (p. 91)[MATHMWST07]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Auction Theory [2590408]

Coordinators: K. Ehrhart
Part of the modules: Decision and Game Theory (p. 118)[MATHMWVWL10], Microeconomic Theory (p. 121)[MATHMW4VWL15]

ECTS Credits	Hours per week	Term	Instruction language
4.5	2/1	Winter term	de

Learning Control / Examinations
The assessment of this course is a written examination (following §4(2), 1 SPO) of 60 mins.
The exam is offered each semester.

Conditions
None.

Recommendations
We suggest to attend either Game Theory I or Decision Theory beforehand.

Learning Outcomes
The student

- learns the game-theoretic modeling and analysis of auctions,
- learns about various auction formats and their specific characteristics,
- understands the challenge for participating in auctions as bidder,
- understands the challenge of designing auctions as auctioneer,
- gains insight into practice by case studies,
- participates in and analyzes demonstration experiments.

Content
This course deals with the analysis and modeling of auction which are based on game theory. This also includes aspects of applying and designing auctions as well as experiences with auctions. Main topics are:

- Single- and multi-unit auctions
- Selling and procurement auctions
- Electronic auctions (e.g. eBay, C2C, B2B)
- Multi-attributive auctions.

Media
Script, overhead slides, additional printed material.

Basic literature

- Ehrhart , K.-M. und S. Seifert: Auktionstheorie, Skript zur Vorlesung, KIT, 2011
- Krishna, V.: Auction Theory, Academic Press, Second Edition, 2010
- Milgrom, P.: Putting Auction Theory to Work, Cambridge University Press, 2004
- Ausubel, L.M. und P. Cramton: Demand Reduction and Inefficiency in Multi-Unit Auctions, University of Maryland, 1999

Course: Medical imaging [MATHNM15]

Coordinators: A. Rieder
Part of the modules: Medical imaging (p. 66)[MATHMWNM15]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Exchanges [2530296]

Coordinators: J. Franke
Part of the modules: Finance 3 (p. 111)[MATH4BWLFBV11], Finance 2 (p. 110)[MATHMWBWLFBV2]

ECTS Credits	Hours per week	Term	Instruction language
1,5	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes
Students are in a position to discuss and evaluate current developments regarding the organisation of exchanges and securities trading.

Content

- Organisation of exchanges: Changing Zeitgeist - Corporates instead of cooparative structures
- Market models: order driven vs. market maker - Liquidity provision for less frequently traded securities
- Trading systems: The end of an era? - No more need for running traders?
- Clearing: Diversity instead of uniformity - Safety for all?
- Settlement: Increasing importance - Does efficient settlement assure the “value added” of exchanges in the long run?

Basic literature
Elective literature:
Educational material will be offered within the lecture.

Course: Brownian Motion [MATHST10]

Coordinators: N. Bäuerle, V. Fasen, N. Henze, G. Last
Part of the modules: Brownian Motion (p. 94)[MATHMWST10]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Business Plan Workshop [2572184]

Coordinators: M. Klarmann, O. Terzidis
Part of the modules: Marketing Management (p. 115)[MATHMWBWLMAR5]

ECTS Credits	Hours per week	Term	Instruction language
3	1	Summer term	de

Learning Control / Examinations
See German version.

Conditions
None.

Learning Outcomes
See German version.

Content
In this workshop the students work in groups to develop a business plan for an innovative business concept.

Remarks
For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).
Please note: This course will not be offered in summer term 2015.

Course: Challenges in Supply Chain Management [n.n.]

Coordinators: R. Blackburn
Part of the modules: Operations Research in Supply Chain Management and Health Care Management (p. 130)[MATHMWOR8]

ECTS Credits	Hours per week	Term	Instruction language
4,5	3	Summer term	en

Learning Control / Examinations
The assessment consists of a written paper and an oral exam (according to §4(2), 3 of the examination regulation).

Conditions
Basic knowledge as conveyed in the module “Introduction to Operations Research [WI1OR]” is assumed.

Recommendations
Advanced knowledge of Operations Research (e.g., as conveyed in the lectures Facility Location and Strategic SCM, Tactical and operational SCM) is recommended.

Learning Outcomes
The student
- analyzes and evaluates current developments and approaches in the design and planning of supply chain strategis, especially with respect to future challenges in this area,
- explains and utilizes theoretical concepts and methods for the design and strategy of supply chains,
- classifies and accounts for trend-setting theories in the SCM context such as Behavioral Supply Chain Management or Supply Chain Analytics.

Content
The course consists of case studies of BASF which cover future challenges of supply chain management. Thus, the course aims at a case-study based presentation, critical evaluation and exemplary discussion of recent questions in supply chain management. The focus lies on future challenges and trends, also with regard to their applicability in practical cases (especially in the chemical industry).
The main part of the course is working on a project together with BASF in Ludwigshafen. The students get in touch with scientific working: The in-depth work with a special scientific topic makes the students familiar with scientific literature research and argumentation methods. As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the project topic.
This course will include working on cutting edge supply chain topics like Industry 4.0 / “Internet of Everything in production”, supply chain analytics, risk management, procurement and production in SCM. The team essays / project reports will be linked to industry-related challenges as well as to upcoming theoretical concepts. The topics of the seminar will be announced at the beginning of the term in a preliminary meeting.

Basic literature
To be defined depending on the topic.

Remarks
Please notice that this course can be attended only in the elective part of the course program.
The number of participants is restricted due to the execution of joint projects with BASF teams and the resulting examination effort. Due to these capacity restrictions, registration before course start is required. For further information see the webpage of the course.
The course is offered irregularly. The planned lectures and courses for the next three years are announced online.

Course: Computational Economics [2590458]

Coordinators: P. Shukla, S. Caton
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	en

Learning Control / Examinations
The assessment consists of a written exam (60 min) (according to §4(2), 1 of the examination regulation). By successful completion of the exercises (according to §4(2), 3 of the examination regulation) a bonus can be obtained. If the grade of the written exam is at least 4.0 and at most 1.3, the bonus will improve it by one grade level (i.e. by 0.3 or 0.4). The bonus only applies to the first and second exam of the semester in which it was obtained.

Conditions
None.

Learning Outcomes
The student

- understands the methods of Computational Economics and applies them on practical issues,
- evaluates agent models considering bounded rational behaviour and learning algorithms,
- analyses agent models based on mathematical basics,
- knows the benefits and disadvantages of the different models and how to use them,
- examines and argues the results of a simulation with adequate statistical methods,
- is able to support the chosen solutions with arguments and can explain them.

Content
Examining complex economic problems with classic analytical methods usually requires making numerous simplifying assumptions, for example that agents behave rationally or homogeneously. Recently, widespread availability of computing power gave rise to a new field in economic research that allows the modeling of heterogeneity and forms of bounded rationality: Computational Economics. Within this new discipline, computer based simulation models are used for analyzing complex economic systems. In short, an artificial world is created which captures all relevant aspects of the problem under consideration. Given all exogenous and endogenous factors, the modelled economy evolves over time and different scenarios can be analyzed. Thus, the model can serve as a virtual testbed for hypothesis verification and falsification.

Media

- PowerPoint

Basic literature

- R. Axelrod: “Advancing the art of simulation in social sciences”. R. Conte u.a., Simulating Social Phenomena, Springer, S. 21-40, 1997.
- R. Axtel: “Why agents? On the varied motivations for agent computing in the social sciences”. CSED Working Paper No. 17, The Brookings Institution, 2000.
- K. Judd: “Numerical Methods in Economics”. MIT Press, 1998, Kapitel 6-7.
- A. M. Law and W. D. Kelton: “Simulation Modeling and Analysis”, McGraw-Hill, 2000.
- R. Sargent: “Simulation model verification and validation”. Winter Simulation Conference, 1991.
- L. Tesfation: “Notes on Learning”, Technical Report, 2004.
- L. Tesfatsion: “Agent-based computational economics”. ISU Technical Report, 2003.

Elective literature:

- Amman, H., Kendrick, D., Rust, J.: “Handbook of Computational Economics”. Volume 1, Elsevier North-Holland, 1996.
- Tesfatsion, L., Judd, K.L.: “Handbook of Computational Economics”. Volume 2: Agent-Based Computational Economics, Elsevier North-Holland, 2006.
- Marimon, R., Scott, A.: “Computational Methods for the Study of Dynamic Economies”. Oxford University Press, 1999.
- Gilbert, N., Troitzsch, K.: “Simulation for the Social Scientist”. Open University Press, 1999.

Remarks
This course is offered in cooperation with the Institute of Applied Informatics and Formal Description Models (AIFB).

Course: Computer-Assisted Analytical Methods for Boundary and Eigenvalue Problems [MATHAN11]

Coordinators: M. Plum
Part of the modules: Computer-Assisted Analytical Methods for Boundary and Eigenvalue Problems (p. 44)[MATHMWAN11]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Corporate Financial Policy [2530214]

Coordinators: M. Ruckes
Part of the modules: Finance 2 (p. 110)[MATHMWBWLFBV2], Economic Theory and its Application in Finance (p. 120)[MATHMW4VWL14], Finance 3 (p. 111)[MATH4BWLFBV11]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	en

Learning Control / Examinations

Conditions
None.

Learning Outcomes
Students

- are in a position to explain the importance of informational frictions for the financing of firms,
- are able to evaluate financing contracts with respect to their incentive effects,
- are able to analyse financing contracts with respect to their information they provide to outsiders,
- are in a position to derive optimal financing contracts in prototypical situations,
- are able to discuss the financial determinants of corporate distribution policy.

Content
The course is concerned with the theory of corporate financing:

- Financing contracts
- Financing capacity
- Issuance of securities
- Capital structure
- Payout policy

Basic literature
Elective literature:
Tirole, J. (2006): The Theory of Corporate Finance. Princeton University Press.

Course: Current Issues in the Insurance Industry [2530350]

Coordinators: W. Heilmann
Part of the modules: Insurance Management I (p. 112)[MATHMWBWLFBV6]

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

Learning Control / Examinations
The assessment consists of a written exam (according to Section 4 (2), 1 of the examination regulation) .
The exam takes place every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Recommendations
For the understanding of this course knowledge of *Private and Social Insurance* [2530050] is required.

Learning Outcomes
Knowledge and understanding of important current characteristics of insurance, e.g. insurance markets, lines, products, investment, company pension schemes, corporate structures and governance as well as controlling.

Content
Current topics in insurance markets.

Basic literature
Elective literature:
Farny, D. Versicherungsbetriebslehre. Verlag Versicherungswirtschaft; Auflage: 5. 2011
Koch, P. Versicherungswirtschaft - Ein einführender Überblick. Verlag Versicherungswirtschaft. 2005
Tonndorf, F., Horn, G., and Bohner, N. Lebensversicherung von A-Z. Verlag Versicherungswirtschaft. 1999
Fürstenwerth, J., andWeiß, A. Versicherungsalphabet (VA). Verlag Versicherungswirtschaft. 2001
Buttler, A. Einführung in die betriebliche Altersversorgung. Verlag Versicherungswirtschaft. 2008
Liebwein, P. Klassische und moderne Formen der Rückversicherung. Verlag Versicherungswirtschaft. 2009
Gesamtverband der Deutschen Versicherungswirtschaft. *Jahrbuch 2011 Die deutsche Versicherungswirtschaft.*
http://www.gdv.de/wp-content/uploads/2011/11/GDV_Jahrbuch_2011.pdf. 2011
Deutsch, E. Das neue Versicherungsvertragsrecht. Verlag Versicherungswirtschaft. 2008
Schwebler, Knauth, Simmert. Kapitalanlagepolitik im Versicherungsbinnenmarkt. 1994
Seng. Betriebliche Altersversorgung. 1995
von Treuberg, Angermayer. Jahresabschluss von Versicherungsunternehmen. 1995

Remarks
Block course. For organizational reasons, please register with the secretay of the chair: thomas.mueller3@kit.edu.
The credits have been changed from 2,5 to 2.

Course: Representation Theory of Finite Groups [MATHAG36]

Coordinators: F. Januszewski , S. Kühnlein
Part of the modules: Representation Theory of Finite Groups (p. 37)[MATHAG36]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Data Mining [2520375]

Coordinators: G. Nakhaeizadeh
Part of the modules: Statistical Methods in Risk Management (p. 125)[MATHMW4STAT2]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2	Winter / Summer Term	de

Learning Control / Examinations

- Oral examination 70%
- Conduction of a small empirical study 30%

Conditions
None.

Learning Outcomes
After completing of the course the students:

- know the definition of Data Mining
- are familiar with the CRISP-DM
- are Familiar with at least six important Data Mining Tasks
- can recognize whether a given problem can be formulated as a data mining problem
- are familiar with the most important Data Mining Algorithms like Decision Tree, K-Means, Artificial Neural Networks, Association Rules, Regression Analysis
- are familiar with evaluation of DM-algorithms
- will be able to use a DM-Tool

Content
Part one: Data Mining
Why Data Mining?

- What is Data Mining?
- History of Data Mining
- Conferences and Journals on Data Mining
- Potential Applications
- Data Mining Process:
- Business Understanding
- Data Understanding
- Data Preparation
- Modeling
- Evaluation
- Deployment
- Interdisciplinary aspects of Data Mining
- Data Mining tasks
- Data Mining Algorithms (Decision Trees, Association Rules,
- Regression, Clustering, Neural Networks)
- Fuzzy Mining
- OLAP and Data Warehouse
- Data Mining Tools
- Trends in Data Mining

Part two: Examples of application of Data Mining

- Success parameters of Data Mining Projects
- Application in industry

- Application in Commerce

Basic literature
U. Fayyad, G. Piatetsky-Shapiro, P. Smyth, R. Uthurusamy, editors, Advances in Knowledge Discovery and Data Mining, AAAI/MIT Press, 1996 (order on-line from Amazon.com or from MIT Press).

- Jiawei Han, Micheline Kamber, Data Mining : Concepts and Techniques, 2nd edition, Morgan Kaufmann, ISBN 1558609016, 2006.
- David J. Hand, Heikki Mannila and Padhraic Smyth, Principles of Data Mining , MIT Press, Fall 2000
- Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Springer Verlag, 2001.
- Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Addison wesley (May, 2005). Hardcover: 769 pages. ISBN: 0321321367
- Ripley, B.D. (1996) Pattern Recognition and Neural Networks, Cambridge: Cambridge University Press.
- Ian witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, 2nd Edition, Morgan Kaufmann, ISBN 0120884070, 2005.

Remarks
The credits for the course have been changed from 5 to 4,5 from summer term 2015 on.

Course: Database Systems and XML [2511202]

Coordinators: A. Oberweis
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Winter term	de

Learning Control / Examinations
The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation in the first week after lecture period.

Conditions
None.

Learning Outcomes
Students

- know the basics of XML and generate XML documents,
- are able to use XML database systems and to formulate queries to XML documents,
- know to assess the use of XML in operational practice in different application contexts.

Content
Databases are a proven technology for managing large amounts of data. The oldest database model, the hierarchical model, was replaced by different models such as the relational or the object-oriented data model. The hierarchical model became particularly more important with the emergence of the extensible Markup Language XML. XML is a data format for structured, semi-structured, and unstructured data. In order to store XML documents consistently and reliably, databases or extensions of existing data base systems are required. Among other things, this lecture covers the data model of XML, concepts of XML query languages, aspects of storage of XML documents, and XML-oriented database systems.

Media
Slides, access to internet resources.

Basic literature

- M. Klettke, H. Meyer: XML & Datenbanken: Konzepte, Sprachen und Systeme. dpunkt.verlag 2003
- H. Schöning: XML und Datenbanken: Konzepte und Systeme. Carl Hanser Verlag 2003
- W. Kazakos, A. Schmidt, P. Tomchyk: Datenbanken und XML. Springer-Verlag 2002
- R. Elmasri, S. B. Navathe: Grundlagen der Datenbanksysteme. 2009
- G. Vossen: Datenbankmodelle, Datenbanksprachen und Datenbankmanagementsysteme. Oldenbourg 2008

Course: Poisson processes [MATHST20]

Coordinators: V. Fasen, D. Hug, G. Last
Part of the modules: Poisson processes (p. 102)[MATHST20]

ECTS Credits	Hours per week	Term	Instruction language
5	2/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Derivatives [2530550]

Coordinators: M. Uhrig-Homburg
Part of the modules: Finance 3 (p. 111)[MATH4BWLFBV11], Finance 2 (p. 110)[MATHMWBWLFBV2], Finance 1 (p. 109)[MATHMWBWLFBV1]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes
The objective of the Derivatives lecture is to become familiar with financial markets, especially derivatives markets. Traded securities and frequently used trading strategies will be introduced. Furthermore the pricing of derivatives will be derived and their use in risk management will be discussed.

Content
The lecture deals with the application areas and valuation of financial derivatives. After an overview of the most important derivatives and their relevance, forwards and futures are analysed. Then, an introduction to the Option Pricing Theory follows. The main emphasis is on option valuation in discrete and continuous time models. Finally, construction and usage of derivatives are discussed, e.g. in the context of risk management.

Media
Slides, Exercises/Exercise sheets

Basic literature

- Hull (2012): Options, Futures, & Other Derivatives, Prentice Hall, 8th Edition

Elective literature:
Cox/Rubinstein (1985): Option Markets, Prentice Hall

Course: Differential Geometry [1036]

Coordinators: S. Grensing , E. Leuzinger, G. Link, W. Tuschmann
Part of the modules: Differential Geometry (p. 23)[MATHMWAG04]

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

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Learning Outcomes

Content

Course: Document Management and Groupware Systems [2511212]

Coordinators: S. Klink
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

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

Learning Control / Examinations
The assessment consists of an 1h written exam in the first week after lecture period according to Section 4(2), 1 of the examination regulation).

Conditions
None.

Learning Outcomes
Students master the basics of integration and structure of document management systems (DMS) and know the complete DMS process - from document capture of the archiving until retrieval. Students know how to realize operative workflows. They know which activities are needed to carry out the conceptual design and installation of DMS and they are able to apply a DMS as an archive system, workflow system and retrieval system. Furthermore, they know groupware systems exemplarily and can use them for collaborative tasks.

Content
The lecture gives basics of document management and groupware systems. It covers different system categories, their interaction and their use areas and illustrates this with concrete examples. These include document management in the strict sense, scanning, Document Imaging (acquisition and visualization of scanned documents), indexing, electronic archiving, retrieval of relevant documents, workflow, groupware, and office communications.

Media
Slides, access to internet resources.

Basic literature

- Klaus Götzer, Udo Schneiderath, Berthold Maier, Torsten Komke: Dokumenten-Management. Dpunkt Verlag, 2004, 358 Seiten, ISBN 3-8986425-8-5
- Jürgen Gulbins, Markus Seyfried, Hans Strack-Zimmermann: Dokumenten-Management. Springer, Berlin, 2002, 700 Seiten, ISBN 3-5404357-7-8
- Uwe M. Borghoff, Peter Rödig, Jan Scheffcyk, Lothar Schmitz: Langzeitarchivierung – Methoden zur Erhaltung digitaler Dokumente. Dpunkt Verlag, 2003, 299 Seiten, ISBN 3-89864-258-5

Elective literature:
Further literature is given in each lecture individually.

Course: Efficient Energy Systems and Electric Mobility [2581006]

Coordinators: R. McKenna, P. Jochem
Part of the modules: Energy Economics and Technology (p. 113)[MATHMWBWLIIP5]

ECTS Credits	Hours per week	Term	Instruction language
3,5	2/0	Summer term	en

Learning Control / Examinations

Conditions
None.

Learning Outcomes

- Understand the concept of energy efficiency as applied to specific systems
- Obtain an overview of the current trends in energy efficiency
- Be able to determine and evaluate alternative methods of energy efficiency improvement
- Overview of technical and economical stylized facts on electric mobility
- Judging economical, ecological and social impacts through electric mobility

Content
This lecture series combines two of the most central topics in the field of energy economics at present, namely energy efficiency and electric mobility. The objective of the lecture is to provide an introduction and overview to these two subject areas, including theoretical as well as practical aspects, such as the technologies, political framework conditions and broader implications of these for national and international energy systems.
The energy efficiency part of the lecture provides an introduction to the concept of energy efficiency, the means of affecting it and the relevant framework conditions. Further insights into economy-wide measurements of energy efficiency, and associated difficulties, are given with recourse to several practical examples. The problems associated with market failures in this area are also highlighted, including the Rebound Effect. Finally and by way of an outlook, perspectives for energy efficiency in diverse economic sectors are examined.
The electric mobility part of the lecture examines all relevant issues associated with an increased penetration of electric vehicles including their technology, their impact on the electricity system (power plants and grid), their environmental impact as well as their optimal integration in the future private electricity demand (i.e. smart grids and V2G). Besides technical aspects the user acceptance and behavioral aspects are also discussed.

Media
Media will likely be provided on the e-learning platform ILIAS.

Basic literature
Will be anounced in the lecture.

Course: Efficient Algorithms [2511100]

Coordinators: H. Schmeck
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Summer term	de

Learning Control / Examinations
The assessment consists of assignments or of a bonus exam (wrt §4 (2), 3 SPO), and a written exam (60 min.) in the week after the end of the lecturing periodwrt (§4 (2), 1 SPO).
If the mark obtained in the written exam is in between 1.3 and 4.0, a successful completion of the assignments or the bonus exam will improve the mark by one level (i.e. by 0.3 or 0.4).
Deviations from this type of assessment are announced at the beginning of this course.

Conditions
credits for the Informatics modules of years 1 and 2.

Learning Outcomes
The student will learn how to use methods and concepts of efficient algorithms and how to demonstrate adequate innovative capabilities with respect to the used methods.
This course emphasizes the teaching of advanced concepts for the design and application of algorithms, data structures, and computer infrastructures in relation to their applicability in the real world. Based on a fundamental understanding of the covered concepts and methods, students should know how to select appropriate concepts and methods for problem settings in their professional life, and, if necessary, to extend and apply them in an adequate form. The students should be enabled to find adequate arguments for justifying their chosen problem solutions.

Content
In a problem oriented way the course presents systematic approaches to the design and analysis of efficient algorithms using standard tasks of information processing as generic examples. Special emphasis is put on the influence of data structures and computer architectures on the performance and cost of algorithms.In particular, the course emphasizes the design and analysis of algorithms on parallel computers and in hardware, which is increasingly important considering the growing presence of multicore architectures.

Media

- powerpoint slides with annotations using a tablet pc
- access to applets and Internet ressources
- lecture recording (camtasia)

Basic literature
Akl, S.G.: The Design and Analysis of Parallel Algorithms. Prentice-Hall, Englewood Cliffs, New Jersey,1989.
Borodin, Munro: The Computational Complexity of Algebraic and Numeric Problems (Elsevier 1975)
Cormen, Leiserson, Rivest: Introduction to Algorithms (MIT Press)
Sedgewick: Algorithms (Addison-Wesley) (many different versions available)
Elective literature:
will be announced in class

Course: eFinance: Information Engineering and Management for Securities Trading [2540454]

Coordinators: C. Weinhardt
Part of the modules: Finance 2 (p. 110)[MATHMWBWLFBV2], Finance 3 (p. 111)[MATH4BWLFBV11]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	en

Learning Control / Examinations
The assessment consists of a written exam (60 min) (according to §4(2), 1 of the examination regulation) and by submitting written essays as part of the exercise (according to §4(2), 3 of the examination regulation). 70% of the final grade is based on the written exam and 30% is based on assignments from the exercises. The points obtained in the exercises only apply to the first and second exam of the semester in which they were obtained.

Conditions
None.

Learning Outcomes
The students

- are able to understand the theoretical and pracitical aspects of securitites trading,
- are able to handle the relevant electronic tools for the evaluation of financial data,
- are able to identify the incentives of the traders for participation in different market plattforms,
- are able to analyse capital marketplaces concerning their efficiency, weaknesses and technical configuration,
- are able to apply theoretical methods of econometrics,
- are able to understand, criticize and present articles with a finance-scientific background,
- learn to elaborate solutions in a team.

Content
The theoretical part of the course examines the New Institutions Economics which provides a theoretically found explanation for the existence of markets and intermediaries. Building upon the foundations of the market micro structure, several key parameters and factors of electronic trading are examined. These insights gained along a structured securities trading process are complemented and verified by the analysis of prototypical trading systems developed at the institute as well as selected trading systems used by leading exchanges in the world. In the more practical-oriented second part of the lecture, speakers from practice will give talks about financial trading systems and link the theoretical findings to real-world systems and applications.

Media

- Powerpoint presentations
- recorded lecture available on the internet

Basic literature

- Picot, Arnold, Christine Bortenländer, Heiner Röhrl (1996): "Börsen im Wandel". Knapp, Frankfurt
- Harris, Larry (2003): "Trading and Exchanges - Market Microstructure for Practitioners"". Oxford University Press, New York

Elective literature:

- Gomber, Peter (2000): "Elektronische Handelssysteme - Innovative Konzepte und Technologien". Physika Verlag, Heidelberg
- Schwartz, Robert A., Reto Francioni (2004): "Equity Markets in Action - The Fundamentals of Liquidity, Market Structure and Trading". Wiley, Hoboken, NJ

Course: Introduction to scientific computing [EWR]

Coordinators: W. Dörfler, M. Hochbruck, T. Jahnke, A. Rieder, C. Wieners
Part of the modules: Introduction to scientific computing (p. 58)[MATHMWNM05]

ECTS Credits	Hours per week	Term	Instruction language
8	3/3	Summer term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Introduction to Matlab and numerical algorithms [MATHNM43]

Coordinators: D. Weiß, C. Wieners
Part of the modules: Introduction to Matlab and numerical algorithms (p. 87)[MATHNM43]

ECTS Credits	Hours per week	Term	Instruction language
5	2/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Theory of endogenous growth [2561503]

Coordinators: I. Ott
Part of the modules: Innovation and growth (p. 117)[MATHMWVWLIWW1], Growth and Agglomeration (p. 119)[MATHMWVWL12]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam (60 min) according to Section 4(2), 1 of the examination regulation. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.
Students will be given the opportunity of writing and presenting a short paper during the lecture time to achieve a bonus on the exam grade. If the mandatory credit point exam is passed, the awarded bonus points will be added to the regular exam points. A deterioration is not possible by definition, and a grade does not necessarily improve, but is very likely to (not every additional point improves the total number of points, since a grade can not become better than 1). The voluntary elaboration of such a paper can not countervail a fail in the exam.

Conditions
None.

Recommendations
Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012], and Economics II [2600014]. In addition, an interest in quantitative-mathematical modeling is required.

Learning Outcomes
Students shall be given the ability to understand, analyze and evaluate selected models of endogenous growth theory.

Content

- Basic models of endogenous growth
- Human capital and economic growth
- Modelling of technological progress
- Diversity Models
- Schumpeterian growth
- Directional technological progress
- Diffusion of technologies

Media

- lecture slides
- exercises

Basic literature
Excerpt:

- Acemoglu, D. (2008): Introduction to modern economic growth. Princeton University Press, New Jersey.
- Aghion, P., Howitt, P. (2009): Economics of growth, MIT-Press, Cambridge/MA.
- Barro, R.J., Sala-I-Martin, X. (2003): Economic Growth. MIT-Press, Cambridge/MA.
- Sydsaeter, K., Hammond, P. (2008): Essential mathematics for economic analysis. Prentice Hall International, Harlow.
- Sydsæter, K., Hammond, P., Seierstad, A., Strom, A., (2008): Further Mathematics for Economic Analysis, Second Edition, Pearson Education Limited, Essex.

Course: Energy and Environment [2581003]

Coordinators: U. Karl, n.n.
Part of the modules: Energy Economics and Technology (p. 113)[MATHMWBWLIIP5]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	de

Learning Control / Examinations
The examination will be in form of an written exam acc. to §4(2), 2 ER.

Conditions
None.

Learning Outcomes
The student should identify environmental problems of energy from fossil fuels. The student can identify appropriate technologies for pollution control. The student knows methods for assessing environmental problems and their ways of application.

Content
The focus of the lecture is put on environmental impacts of fossil fuel conversion and related assessment methods. The list of topics is given below.

- Fundamentals of energy conversion
- Air pollutant formation from fossil fuel combustion
- Control of air pollutant emissions from fossil-fuelled power plants.
- Measures to improve conversion efficiency of fossil fuelled power plants.
- External effects of energy supply (Life Cycle Assessment of selected energy systems)
- Integrated Assessment models supporting the European Thematic Strategy on Air
- Cost-effectiveness analyses and cost-benefit analyses of air pollution control measures
- Monetary evaluation of external effects of energy supply (external costs)

Course: Energy Systems Analysis [2581002]

Coordinators: V. Bertsch
Part of the modules: Energy Economics and Technology (p. 113)[MATHMWBWLIIP5]

ECTS Credits	Hours per week	Term	Instruction language
3	2/0	Winter term	en

Learning Control / Examinations
The assessment consists of a written exam according to Section 4(2), 1 of the examination regulation.

Conditions
None.

Learning Outcomes
The student
- has the ability to understand and critically reflect the methods of energy system analysis, the possibilities of its application in the energy industry and the limits and weaknesses of this approach
- can use select methods of the energy system analysis by her-/himself

Content
1. Overview and classification of energy systems modelling approaches
2. Usage of scenario techniques for energy systems analysis
3. Unit commitment of power plants
4. Interdependencies in energy economics
5. Scenario-based decision making in the energy sector
6. Visualisation and GIS techniques for decision support in the energy sector

Media
Media will likely be provided on the e-learning platform ILIAS.

Remarks
Since 2011 the lecture is offered in winter term. Exams can still be taken in summer term.

Course: Enterprise Architecture Management [2511600]

Coordinators: T. Wolf
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Winter term	de

Learning Control / Examinations
The assessment of this course is a written or (if necessary) oral examination according to §4(2) of the examination regulation.

Conditions
None.

Learning Outcomes
Students understand the connection between enterprise strategy, business processes and business objects and IT architecture; they know methods to depict these connections and how they can be developed based on each other.

Content
The following topics will be covered: components of enterprise architecture, enterprise strategy including methods to develop strategies, business process (re)engineering, methods to implement changes within enterprises (management of change)

Media
Slides, access to internet resources.

Basic literature

- Nolan, R., Croson, D.: Creative Destruction: A Six-Stage Process for Transforming the Organization. Harvard Business School Press, Boston Mass. 1995
- Doppler, K., Lauterburg, Ch.: Change Management. Campus Verlag 1997
- Jacobson, I.: The Object Advantage, Business Process Reengineering with Object Technology. Addison-Wesley Publishing Company, Wokingham England 1994
- Keller, G., Teufel, Th.: SAP R/3 prozessorientiert anwenden. Addison Wesley 1998
- Österle, H.: Business Engineering Bd. 1 und 2. Springer Verlag, Berlin 1995

Course: Decision Theory [2520365]

Coordinators: K. Ehrhart
Part of the modules: Decision and Game Theory (p. 118)[MATHMWVWL10]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	de

Learning Control / Examinations
The assessment of this course is a written examination (following §4(2), 1 SPO) of 60 mins.
The exam is offered each semester.

Conditions
None.

Recommendations
See corresponding module information.
Knowledge in mathematics and statistics is required.

Learning Outcomes
The student will be made familiar with the basics in modern decision making particularly under uncertainty so that she will be able to analyze concrete decision problems and to develop simple solution procedures. By being confronted with experimental results in decision making the student should also be able to evaluate the behavioral part of decision making.

Content
This course deals with problems of decision making particularly under uncertainty. We introduce the expected utility theory of Neumann/Morgenstern and the prospect theory of Kahnemann/Tversky and discuss the concepts of stochastic dominance, risk aversion, loss aversion, reference points etc. We also consider the empirical validity of the different approaches. Additionally, the lecture provides an introduction to the theory of findings (epistemology), particularly with respect to decision theory.

Media
Script, overhead slides, additional printed material.

Basic literature

- Ehrhart, K.-M. und S.K. Berninghaus (2012): Decision Theory, Script, KIT.
- Hirshleifer und Riley (1997): The Analytics of Uncertainty and Information. London: Cambridge University Press, 4. Edtion.
- Berninghaus, S.K., K.-M. Ehrhart und W. Güth (2006): Strategische Spiele. Berlin u.a.: Springer, 3., Edtion

Course: Discrete-event Simulation in Production and Logistics [2550488]

Coordinators: S. Nickel, S. Spieckermann
Part of the modules: Operations Research in Supply Chain Management and Health Care Management (p. 130)[MATHMWOR8]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	de

Learning Control / Examinations
The assessment consists of a written paper and an oral exam (according to §4(2), 3 of the examination regulation).

Conditions
Basic knowledge as conveyed in the module *Introduction to Operations Research* [WI1OR] is assumed.

Recommendations
Besides knowledge of Operations Research students are assumed to be familiar with the following topics:

- Introduction in Statistics
- Programming basics (algorithms and data structures)
- Basic knowledge in production and logistics

Learning Outcomes
The student

- knows basic concepts of discrete event simulation models,
- applies computer-based simulation systems,
- structures and implements simulation studies according to specific process models,
- has an in-depthr knowledge for logistics issues and discovers the importance of statistical methods in modeling and evaluation of simulation models,
- explains coupled systems of simulation and meta-heuristics, and characterizes simulation programs.

Content
Simulation of production and logistics systems is an interdisciplinary subject connecting expert knowledge from production management and operations research with mathematics/statistics as well as computer science and software engineering. With completion of this course, students know statistical foundations of discrete simulation, are able to classify and apply related software applications, and know the relation between simulation and optimization as well as a number of application examples. Furthermore, students are enabled to structure simulation studies and are aware of specific project scheduling issues.

Remarks
Due to capacity restrictions, registration before course start is required. For further information see the webpage of the course.
The course is planned to be held every summer term.
The planned lectures and courses for the next three years are announced online.

Course: Additional Topics on Stochastic Analysis [MATHAN40-2]

Coordinators: L. Weis
Part of the modules: Stochastic Evolution Equations (p. 56)[MATHAN40]

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

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Evolution Equations [MATHAN12]

Coordinators: R. Schnaubelt, L. Weis
Part of the modules: Evolution Equations (p. 45)[MATHMWAN12]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Experimental Economics [2540489]

Coordinators: C. Weinhardt, T. Teubner
Part of the modules: Experimental Economics (p. 123)[MATHMW4VWL17], Decision and Game Theory (p. 118)[MATHMWVWL10]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam (60 min) (according to §4(2), 1 of the examination regulation). By successful completion of the exercises (according to §4(2), 3 of the examination regulation) a bonus can be obtained. If the grade of the written exam is at least 4.0 and at most 1.3, the bonus will improve it by one grade level (i.e. by 0.3 or 0.4). The bonus only applies to the first and second exam of the semester in which it was obtained.

Conditions
See corresponding module information.

Learning Outcomes
The students should learn

- how to gain scientific experience and knowledge (philosophy of science),
- how Game Theory and Experimental Economics influenced each other in scientific research,
- about the methods as well as the strengths and weaknesses of Experimental Economics,
- some examples of experimental research, such as markets and auctions, coordination games, bargaining, decision making under risk,
- how to evaluate data.

Content
Experimental Economics have become a separate field in Economics. Nearly all fields of the economic discipline use economic experiments to verify theoretical results. Besides being used for empricial validation, this method is applied in political and strategic consulting. The lecture gives an introduction to experimental methods in economics and shows differences to experiments in natural sciences. Scientific studies are used to show exemplary applications.

Media

- PowerPoint
- E-learning platform ILIAS
- Classroom experiments or experiments in the computer laboratory will be conducted

Basic literature

- Strategische Spiele; S. Berninghaus, K.-M. Ehrhart, W. Güth; Springer Verlag, 2nd ed., 2006.
- Handbook of Experimental Economics; J. Kagel, A. Roth; Princeton University Press, 1995.
- Experiments in Economics; J.D. Hey; Blackwell Publishers, 1991.
- Experimental Economics; D.D. Davis, C.A. Holt; Princeton University Press, 1993.
- Experimental Methods: A Primer for Economists; D. Friedman, S. Sunder; Cambridge University Press, 1994.

Course: Fixed Income Securities [2530260]

Coordinators: M. Uhrig-Homburg
Part of the modules: Finance 2 (p. 110)[MATHMWBWLFBV2], Finance 3 (p. 111)[MATH4BWLFBV11]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes
The objective of this course is to become familiar with national and international bond markets. Therefore, we first have a look at financial instruments that are of particular importance. Thereafter, specific models and methods that allow the evaluation of interest rate derivatives are introduced and applied.

Content
The lecture deals with both German and international bond markets, which are an important source of funding for both the corporate and the public sector. After an overview of the most important bond markets, various definitions of return are discussed. Based on that, the concept of the yield curve is presented. The modelling of the dynamics of the term structure of interest rates provides the theoretical foundation for the valuation of interest rate derivatives, which is discussed in the last part of the lecture.

Basic literature

- Bühler, W., Uhrig-Homburg, M., Rendite und Renditestruktur am Rentenmarkt, in Obst/Hintner, Geld-, Bank- und Börsenwesen - Handbuch des Finanzsystems, (2000), S.298-337.
- Sundaresan, S., Fixed Income Markets and Their Derivatives, Academic Press, 3rd Edition, (2009).

Elective literature:

- Hull, J., Options, Futures, & Other Derivatives, Prentice Hall, 8th Edition, (2012).

Course: Financial Intermediation [2530232]

Coordinators: M. Ruckes
Part of the modules: Finance 3 (p. 111)[MATH4BWLFBV11], Economic Theory and its Application in Finance (p. 120)[MATHMW4VWL14], Finance 2 (p. 110)[MATHMWBWLFBV2]

ECTS Credits	Hours per week	Term	Instruction language
4,5	3	Winter term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes
Students

- are in a position to describe the arguments for the existence of financial intermediaries,
- are able of discuss and analyze both static and dynamic aspects of contractual relationships between banks and borrowers,
- are able to discuss the macroeconomic role of the banking system,
- are in a position to explain the fundamental principles of the prudential regulation of banks and are able to recognize and evaluate the implications of specific regulations.

Content

- Arguments for the existence of financial intermediaries
- Bank loan analysis, relationship lending
- Stability of the financial system
- The macroeconomic role of financial intermediation
- Principles of the prudential regulation of banks

Basic literature
Elective literature:

- Hartmann-Wendels/Pfingsten/Weber (2014): Bankbetriebslehre, 6th edition, Springer Verlag.
- Freixas/Rochet (2008): Microeconomics of Banking, 2nd edition, MIT Press.

Course: Discrete time finance [FMDZ]

Coordinators: N. Bäuerle, V. Fasen
Part of the modules: Discrete time finance (p. 88)[MATHST04]

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

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Learning Outcomes

Content

Course: Mathematical Finance in Continuous Time [MATHST08]

Coordinators: N. Bäuerle, V. Fasen
Part of the modules: Continuous time finance (p. 92)[MATHMWST08]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Summer term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Finite Element Methods [MATHNM07]

Coordinators: W. Dörfler, M. Hochbruck, T. Jahnke, A. Rieder, C. Wieners
Part of the modules: Finite element methods (p. 60)[MATHMWNM07]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Fourier Analysis [MATHAN14]

Coordinators: R. Schnaubelt, L. Weis
Part of the modules: Fourier Analysis (p. 46)[MATHMWAN14]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: [01048]

Coordinators: G. Herzog, D. Hundertmark, T. Lamm, M. Plum, W. Reichel, C. Schmoeger, R. Schnaubelt, L. Weis
Part of the modules: Functional Analysis (p. 39)[MATHMWAN05]

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

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Recommendations
It is recommended to attend the following modules previously:
Linear Algebra 1+2
Analysis 1-3

Learning Outcomes

Content

Course: Complex Analysis II [MATHAN16]

Coordinators: G. Herzog, M. Plum, W. Reichel, C. Schmoeger, R. Schnaubelt, L. Weis
Part of the modules: Complex Analysis II (p. 47)[MATHMWAN16]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Sheaf cohomology in analysis and topology [MATHAG31]

Coordinators: F. Herrlich, F. Januszewski , S. Kühnlein, G. Weitze-Schmithüsen
Part of the modules: Sheaf cohomology in analysis and topology (p. 34)[MATHAG31]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Mixed Integer Programming I [25138]

Coordinators: O. Stein
Part of the modules: Mathematical Programming (p. 132)[MATHMWOR9]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	de

Learning Control / Examinations
The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation.
The examination is held in the semester of the lecture and in the following semester.
Prerequisite for admission to the written examination is attaining at least 30% of the exercise points. Therefore the online-registration for the written examination is subject to fulfilling the prerequisite.
The examination can also be combined with the examination of *Mixed Integer Programming II* [25140]. In this case, the duration of the written examination takes 120 minutes.

Conditions
None.

Recommendations
It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

Learning Outcomes
The student

- knows and understands the fundamentals of linear mixed integer programming,
- is able to choose, design and apply modern techniques of linear mixed integer programming in practice.

Content
Many optimization problems from economics, engineering and natural sciences are modeled with continuous as well as discrete variables. Examples are the energy minimal design of a chemical process in which several reactors may be switched on or off, or the time minimal covering of a distance with a vehicle equipped with a gear shift. While optimal points can be defined straightforwardly, for their numerical identification an interplay of ideas from discrete and continuous optimization is necessary.
The lecture treats methods for the numerical solution of linear optimization problems which depend on continuous as well as discrete variables. It is structured as follows:

- Existence results and concepts of linear as well as convex optimization
- LP relaxation and error bounds for rounding
- Gomory's cutting plane method
- Benders decomposition

Part II of the lecture treats nonlinear mixed integer programs.
The lecture is accompanied by computer exercises in which you can learn the programming language MATLAB and implement and test some of the methods for practically relevant examples.

Media
Lecture notes.

Basic literature
Elective literature:

- C.A. Floudas, Nonlinear and Mixed-Integer Optimization: Fundamentals and Applications, Oxford University Press, 1995
- J. Kallrath: Gemischt-ganzzahlige Optimierung, Vieweg, 2002
- D. Li, X. Sun: Nonlinear Integer Programming, Springer, 2006
- G.L. Nemhauser, L.A. Wolsey, Integer and Combinatorial Optimization, Wiley, 1988
- M. Tawarmalani, N.V. Sahinidis, Convexification and Global Optimization in Continuous and Mixed-Integer Nonlinear Programming, Kluwer, 2002.

Remarks
The lecture is offered irregularly. The curriculum of the next three years is available online (kop.ior.kit.edu).

Course: Mixed Integer Programming II [25140]

Coordinators: O. Stein
Part of the modules: Mathematical Programming (p. 132)[MATHMWOR9]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	de

Learning Control / Examinations
The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation.

The examination is held in the semester of the lecture and in the following semester.

Prerequisite for admission to the written examination is attaining at least 30% of the exercise points. Therefore the online-registration for the written examination is subject to fulfilling the prerequisite.

The examination can also be combined with the examination of *Mixed Integer Programming I* [25138]. In this case, the duration of the written examination takes 120 minutes.

Conditions
None.

Recommendations
It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

Learning Outcomes
The student

- knows and understands the fundamentals of convex and of nonconvex mixed integer programming,
- is able to choose, design and apply modern techniques of nonlinear mixed integer programming in practice.

Content
Many optimization problems from economics, engineering and natural sciences are modeled with continuous as well as discrete variables. Examples are the energy minimal design of a chemical process in which several reactors may be switched on or off, or the time minimal covering of a distance with a vehicle equipped with a gear shift. While optimal points can be defined straightforwardly, for their numerical identification an interplay of ideas from discrete and continuous optimization is necessary. Part I of the lecture deals with linear mixed integer programs.
Part II treats methods for the numerical solution of optimization problems which depend nonlinearly on continuous as well as discrete variables. It is structured as follows:

- Concepts of convex optimization
- Mixed integer convex programming (branch and bound methods)
- Mixed integer nonconvex programming
- Generalized Benders decomposition
- Outer approximation methods
- Heuristics

The lecture is accompanied by computer exercises in which you can learn the programming language MATLAB and implement and test some of the methods for practically relevant examples.

Media
Lecture notes.

Basic literature
Elective literature:

- C.A. Floudas, Nonlinear and Mixed-Integer Optimization: Fundamentals and Applications, Oxford University Press, 1995
- J. Kallrath: Gemischt-ganzzahlige Optimierung, Vieweg, 2002
- D. Li, X. Sun: Nonlinear Integer Programming, Springer, 2006
- G.L. Nemhauser, L.A. Wolsey, Integer and Combinatorial Optimization, Wiley, 1988
- M. Tawarmalani, N.V. Sahinidis, Convexification and Global Optimization in Continuous and Mixed-Integer Nonlinear Programming, Kluwer, 2002.

Remarks
The lecture is offered irregularly. The curriculum of the next three years is available online (kop.ior.kit.edu).

Course: Generalized Regression Models [MATHST09]

Coordinators: N. Henze, B. Klar
Part of the modules: Generalized Regression Models (p. 93)[MATHMWST09]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	Winter term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Geometry of Schemes [MATHAG11]

Coordinators: F. Herrlich, S. Kühnlein, G. Weitze-Schmithüsen
Part of the modules: Geometry of Schemes (p. 28)[MATHMWAG11]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Geometric Group Theory [MATHAG12]

Coordinators: F. Herrlich, E. Leuzinger, R. Sauer, P. Schwer, G. Weitze-Schmithüsen
Part of the modules: Geometric Group Theory (p. 29)[MATHMWAG12]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Summer term	

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Learning Outcomes

Content

Course: Geometric numerical integration [MATHNM31]

Coordinators: M. Hochbruck, T. Jahnke
Part of the modules: Geometric numerical integration (p. 77)[MATHNM31]

ECTS Credits	Hours per week	Term	Instruction language
6	3/1	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Business Strategies of Banks [2530299]

Coordinators: W. Müller
Part of the modules: Finance 2 (p. 110)[MATHMWBWLFBV2], Finance 3 (p. 111)[MATH4BWLFBV11]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
Students are are in a position to discuss the principles of commercial banking. They are familiar with fundamental concepts of bank management and are able to apply them.

Content
The management of a bank is in charge of the determination and implementation of business policy - taking into account all relevant endogenous and exogenous factors - that assures the bank's success in the long run. In this context, there exists a large body of banking models and theories which are helpful in describing the success and risk of a bank. This course is meant to be the bridging of banking theory and practical implementation. In the course of the lectures students will learn to take on the bank management's perspective.
The first chapter deals with the development of the banking sector. Making use of appropriate assumptions, a banking policy is developed in the second chapter. The design of bank services (ch. 3) and the adequate marketing plan (ch. 4) are then built on this framework. The operational business of banks must be guided by appropriate risk and earnings management (ch. 5 and 6), which are part of the overall (global) bank management (ch. 7). Chapter eight, at last, deals with the requirements and demands of bank supervision as they have significant impact on a bank's corporate policy.

Basic literature
Elective literature:

- A script is disseminated chapter by chapter during the course of the lecture.
- Hartmann-Wendels, Thomas; Pfingsten, Andreas; Weber, Martin; 2000, Bankbetriebslehre, 6th edition, Springer

Course: Global Differential Geometry [MATHAG27]

Coordinators: S. Grensing , W. Tuschmann
Part of the modules: Global Differential Geometry (p. 31)[MATHAG27]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Global Optimization I [2550134]

Coordinators: O. Stein
Part of the modules: Mathematical Programming (p. 132)[MATHMWOR9], Methodical Foundations of OR (p. 128)[MATHMWOR6], Applications of Operations Research (p. 126)[MATHMWOR5]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	de

Learning Control / Examinations
The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation.
The examination is held in the semester of the lecture and in the following semester.
Prerequisite for admission to the written examination is attaining at least 50% of the exercise points. Therefore the online-registration for the written examination is subject to fulfilling the prerequisite.
The examination can also be combined with the examination of *Global Optimization II* [2550136]. In this case, the duration of the written examination takes 120 minutes.

Conditions
None.

Learning Outcomes
The student

- knows and understands the fundamentals of deterministic global optimization in the convex case,
- is able to choose, design and apply modern techniques of deterministic global optimization in the convex case in practice.

Content
In many optimization problems from economics, engineering and natural sciences, numerical solution methods are only able to efficiently identify *local* optimizers, while it is much harder to find *globally* optimal points. This corresponds to the fact that by local search it is easy to find the summit of the closest mountain, but that the search for the summit of Mount Everest is rather elaborate.
Part I of the lecture treats methods for global optimization of convex functions under convex constraints. It is structured as follows:

- Introduction, examples, and terminology
- Existence results
- Optimality in convex optimization
- Duality, bounds, and constraint qualifications
- Numerical methods

Nonconvex optimization problems are treated in part II of the lecture.
The lecture is accompanied by computer exercises in which you can learn the programming language MATLAB and implement and test some of the methods for practically relevant examples.

Media
Lecture notes.

Basic literature
Elective literature:

- W. Alt *Numerische Verfahren der konvexen, nichtglatten Optimierung* Teubner 2004
- C.A. Floudas *Deterministic Global Optimization* Kluwer 2000
- R. Horst, H. Tuy *Global Optimization* Springer 1996
- A. Neumaier *Interval Methods for Systems of Equations* Cambridge University Press 1990

Remarks
Part I and II of the lecture are held consecutively in the *same* semester.

Course: Global Optimization II [2550136]

Coordinators: O. Stein
Part of the modules: Methodical Foundations of OR (p. 128)[MATHMWOR6], Mathematical Programming (p. 132)[MATHMWOR9]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	de

Learning Control / Examinations
The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation.
The examination is held in the semester of the lecture and in the following semester.
Prerequisite for admission to the written examination is attaining at least 50% of the exercise points. Therefore the online-registration to the written examinationen is subject to fulfilling the prerequisite.
The examination can also be combined with the examination of *Global Optimization I* [2550134]. In this case, the duration of the written examination takes 120 minutes.

Conditions
None.

Learning Outcomes
The student

- knows and understands the fundamentals of deterministic global optimization in the nonconvex case,
- is able to choose, design and apply modern techniques of deterministic global optimization in the nonconvex case in practice.

Content
In many optimization problems from economics, engineering and natural sciences, numerical solution methods are only able to efficiently identify *local* optimizers, while it is much harder to find *globally* optimal points. This corresponds to the fact that by local search it is easy to find the summit of the closest mountain, but that the search for the summit of Mount Everest is rather elaborate.
The global solution of convex optimization problems is subject of part I of the lecture.
Part II of the lecture treats methods for global optimization of nonconvex functions under nonconvex constraints. It is structured as follows:

- Introduction and examples
- Convex relaxation
- Interval arithmetic
- Convex relaxation via αBB method
- Branch and bound methods
- Lipschitz optimization

The lecture is accompanied by computer exercises in which you can learn the programming language MATLAB and implement and test some of the methods for practically relevant examples.

Media
Lecture notes.

Basic literature
Elective literature:

- W. Alt *Numerische Verfahren der konvexen, nichtglatten Optimierung* Teubner 2004
- C.A. Floudas *Deterministic Global Optimization* Kluwer 2000
- R. Horst, H. Tuy *Global Optimization* Springer 1996
- A. Neumaier *Interval Methods for Systems of Equations* Cambridge University Press 1990

Remarks
Part I and II of the lecture are held consecutively in the *same* semester.

Course: Graph Theory and Advanced Location Models [2550484]

Coordinators: S. Nickel
Part of the modules: Mathematical Programming (p. 132)[MATHMWOR9], Operations Research in Supply Chain Management and Health Care Management (p. 130)[MATHMWOR8]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter / Summer Term	en

Learning Control / Examinations
The assessment is a 120 minutes written examination (according to §4(2), 1 of the examination regulation).
The examination is held in the term of the lecture and the following lecture.

Conditions
Basic knowledge as conveyed in the module *Introduction to Operations Research* [WI1OR] is assumed.

Learning Outcomes
The student

- knows and classifies basic concepts and algorithms of Graph Theory which are used in engineering, economic and socio-scientific problems,
- describes and utilizes models and methods in order to optimize on graphs and networks
- models advanced problem settings in location theory,
- is capable of analyzing practically-relevant settings and current research topics and develops individual solution concepts.

Content
Graph Theory is an important part of Discrete Mathematics. A special attraction is in its clearness and variety of proof techniques. Object of the first part "Graph Theory" is the mediation of basic graph theoretical concepts and algorithms, which are deployed in many areas. In focus is the modeling of different problems with graph theoretical methods und their solutions with efficient algorithms. Significant focal points are Shortest Paths, Flows, Matchings, Colorings and Matroids.
A variety of application areas of location theory has attracted increasing research interest within the last decades, because location decisions are a critical factor in strategic planning. In the second part "Advanced Location Models", some current research questions of modern industrial location theory are discussed after a short introduction. Thereby, practical models and suitable solution methods for location problems in general networks are presented. The lecture goes into details about Pareto Solutions in Networks, Ordered Median Problems, Covering Problems and Allocation Problems.

Basic literature

- Jungnickel: Graphs, Networks and Algorithms, 2nd edition, Springer, 2005
- Diestel: Graph Theory, 3rd edition, Springer, 2006
- Bondy, Murt: Graph Theory, Springer, 2008
- Nickel, Puerto: Location Theory, Springer, 2005
- Drezner: Facility Location – Applications and Theory, 2nd edition, Springer, 2005

Remarks
The lecture is offered irregularly. The planned lectures and courses for the next three years are announced online.

Course: Graph Theory [GraphTH]

Coordinators: M. Axenovich
Part of the modules: Graph Theory (p. 30)[MATHAG26]

ECTS Credits	Hours per week	Term	Instruction language
8	4+2	Winter / Summer Term	en

Learning Control / Examinations

Conditions
None.

Recommendations
It is recommended to attend the following modules previously:
Linear Algebra 1+2, Analysis 1+2

Learning Outcomes
Learning outcomes include: understanding structural and algorithmic properties of graphs, learning about graph colorings, unavoidable structures in graphs, probabilistic methods, properties of large graphs.

Content
The graph theory course covers the material starting with the basic graph properties introduced by Euler and finishing up with modern results and techniques in extremal graph theory. The specific topics include: structure of trees, paths, cycles, walks in graphs, unavoidable subgraphs in dense graphs, planar graphs, graph colorings, Ramsey theory, regularity in graphs.

Course: Innovationtheory and -policy [2560236]

Coordinators: I. Ott
Part of the modules: Innovation and growth (p. 117)[MATHMWVWLIWW1]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (60 min) according to Section 4(2), 1 of the examination regulation. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.
Students will be given the opportunity of writing and presenting a short paper during the lecture time to achieve a bonus on the exam grade. If the mandatory credit point exam is passed, the awarded bonus points will be added to the regular exam points. A deterioration is not possible by definition, and a grade does not necessarily improve, but is very likely to (not every additional point improves the total number of points, since a grade can not become better than 1). The voluntary elaboration of such a paper can not countervail a fail in the exam.

Conditions
None.

Recommendations
Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012], and Economics II [2600014]. In addition, an interest in quantitative-mathematical modeling is required.

Learning Outcomes
Students shall be given the ability to

- identify the importance of alternative incentive mechanisms for the emergence and dissemination of innovations
- understand the relationships between market structure and the development of innovation
- explain, in which situations market interventions by the state, for example taxes and subsidies, can be legitimized, and evaluate them in the light of economic welfare

Content

- Incentives for the emergence of innovations
- Patents
- Diffusion
- Impact of technological progress
- Innovation Policy

Media

- lecture slides
- exercises

Basic literature
Excerpt:

- Aghion, P., Howitt, P. (2009), The Economics of Growth, MIT Press, Cambridge MA.
- de la Fuente, A. (2000), Mathematical Methods and Models for Economists. Cambridge University Press, Cambridge, UK.
- Klodt, H. (1995), Grundlagen der Forschungs- und Technologiepolitik. Vahlen, München.
- Linde, R. (2000), Allokation, Wettbewerb, Verteilung - Theorie, UNIBUCH Verlag, Lüneburg.
- Ruttan, V. W. (2001), Technology, Growth, and Development. Oxford University Press, Oxford.
- Scotchmer, S. (2004), Incentives and Innovation, MIT Press.
- Tirole, Jean (1988), The Theory of Industrial Organization, MIT Press, Cambridge MA.

Course: Insurance Marketing [2530323]

Coordinators: E. Schwake
Part of the modules: Insurance Management I (p. 112)[MATHMWBWLFBV6]

ECTS Credits	Hours per week	Term	Instruction language
4,5	3/0	Summer term	de

Learning Control / Examinations
The assessment consists of oral presentations (incl. papers) within the lecture (according to Section 4 (2), 3 of the examination regulation) and a final oral exam (according to Section 4 (2), 2 of the examination regulation).
The overall grade consists of the assessment of the oral presentations incl. papers (50 percent) and the assessment of the oral exam (50 percent).

Conditions
None.

Learning Outcomes
See German version.

Content
See German version.

Basic literature
Elective literature:

- Farny, D.. Versicherungsbetriebslehre (Kapitel III.3 sowie V.4). Karlsruhe 2011
- Kurtenbach / Kühlmann / Käßer-Pawelka. Versicherungsmarketing. . . . Frankfurt 2001
- Wiedemann, K.-P./Klee, A. Ertragsorientiertes Zielkundenmanagement für Finanzdienstleister, Wiesbaden 2003

Course: Insurance Production [2530324]

Coordinators: U. Werner
Part of the modules: Insurance Management I (p. 112)[MATHMWBWLFBV6]

ECTS Credits	Hours per week	Term	Instruction language
4,5	3/0	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists of oral presentations (incl. papers) within the lecture (according to Section 4 (2), 3 of the examination regulation) and a final oral exam (according to Section 4 (2), 2 of the examination regulation).
The overall grade consists of the assessment of the oral presentations incl. papers (50 percent) and the assessment of the oral exam (50 percent).

Conditions
None.

Learning Outcomes
See German version.

Content
See German version.

Basic literature
Elective literature:
P. Albrecht. Zur Risikotransformationstheorie der Versicherung: Grundlagen und ökonomische Konsequenzen. Mannheimer Manuskripte zur Versicherungsbetriebslehre und Risikotheorie Nr. 36
D. Farny. Versicherungsbetriebslehre. 2011.
H. Neugebauer. Kostentheorie und Kostenrechnung für Versicherungsunternehmen. 1995
A. Wiesehan. Geschäftsprozessoptimierung für Versicherungsunternehmen. München 2001

Remarks
This course is offered on demand. For further information, see: http://insurance.fbv.uni-karlsruhe.de

Course: Insurance Risk Management [2530335]

Coordinators: H. Maser
Part of the modules: Insurance Management I (p. 112)[MATHMWBWLFBV6]

ECTS Credits	Hours per week	Term	Instruction language
2,5	2/0	Summer term	de

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

Conditions
None.

Learning Outcomes
Getting to know basic principles of risk management in insurance companies and credit institutions.

Content

Basic literature
Elective literature:

- ”Mindestanforderungen an ein (Bank-)Risikomanagement”, www.bafin.de
- V. Bieta, W. Siebe. Strategisches Risikomanagement in Versicherungen. in: ZVersWiss 2002 S. 203-221.
- A. Schäfer. Subprime-Krise, in: VW2008, S. 167-169.
- B. Rudolph. Lehren aus den Ursachen und dem Verlauf der internationalen Finanzkrise, in: zfbf 2008, S. 713-741.

Remarks
Block course. For organizational reasons, please register with the secretary of the chair: thomas.mueller3@kit.edu.

Course: Integral Equations [IG]

Coordinators: T. Arens, F. Hettlich, A. Kirsch
Part of the modules: Integral Equations (p. 40)[MATHMWAN07]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2		

Learning Control / Examinations

Conditions
None.

Recommendations
It is recommended to attend the following modules previously:
Linear Algebra 1+2
Analysis 1-3

Learning Outcomes
The students can

- formulate and classify integral equations,
- discuss existence and uniqueness of integral equations,
- reformulate models based on applications by integral equations.

Content

- Riesz and Fredholm theory,
- Fredholm und Volterra integral equations of second kind,
- applications in potential theory,
- convolution equations

Course: International Finance [2530570]

Coordinators: M. Uhrig-Homburg, Dr. Walter
Part of the modules: Finance 3 (p. 111)[MATH4BWLFBV11], Finance 2 (p. 110)[MATHMWBWLFBV2]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
The objective of this course is to become familiar with the basics of investment decisions on international markets and to manage foreign exchange risks.

Content
The main aspects of this course are the chances and the risks which are associated with international transactions. We carry out our analysis from two distinct perspectives: First the point of view of an international investor second that, of an international corporation. Several alternatives to the management of foreign exchange risks are shown. Due to the importance of foreign exchange risks, the first part of the course deals with currency markets. Furthermore current exchange rate theories are discussed.

Basic literature
Elective literature:

- Eiteman, D. et al., Multinational Business Finance, 13. edition, 2012.
- Solnik, B. and D. McLeavey, Global Investments, 6. edition, 2008.

Course: International Economic Policy [2560254]

Coordinators: J. Kowalski
Part of the modules: Growth and Agglomeration (p. 119)[MATHMWVWL12]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (60min) according to Setion 4(2), 1 of the examination regulation.
The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Recommendations
Previous visit of the lectures *Economics II: Macroeconomics* [2600014] is recommended.

Learning Outcomes
The student gets aquianted with various modern doctrines and theories pertinent to international economic policy. They shoud understand the structure of the institutional framework relevant for the global economy and the way it functions. They should be able to form their own jugement on the strategies, measures and outcomes of actions of various actors dealing with the international economic policy.

Content

Basic literature
Elective literature:

- World Bank: “World Development Report”. 2008, 2009
- Wagner, M.: „Einführung in die Weltwirtschaftspolitik“. Oldenbourg 1995
- Gerber, J.: „International Economics“, Pearson, 2007, IV Edition weitere Angaben in der Vorlesung
- Rodrik, D.: “The Globalization Paradox”. London 2011.

Remarks
The examination will be offered latest until summer term 2016 (repeaters only).

Course: Cost and Management Accounting [2530210]

Coordinators: T. Lüdecke
Part of the modules: Finance 2 (p. 110)[MATHMWBWLFBV2], Finance 3 (p. 111)[MATH4BWLFBV11]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (60 min) taking place in the recess period (according to §4 (2), 1 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Learning Outcomes
This course aims at providing students with the understanding of the purposes of alternative costing systems as well as the use of relevant information for decision making. The course will also examine techniques for the purpose of cost management and accounting for control.

Content

- Design of Cost Systems
- Cost Classifications, Cost Behavior, and Principles of Cost Allocation
- Activity-based Costing
- Product Costing
- Production Decisions
- Cost-based Pricing
- Cost Management
- Decisions under Risk
- Cost Accounting for Control

Basic literature
Elective literature:

- Coenenberg, A.G. Kostenrechnung und Kostenanalyse, 6. Aufl. 2007.
- Ewert, R. und Wagenhofer, A. Interne Unternehmensrechnung, 7. Aufl. 2008.
- Götze, U. Kostenrechnung und Kostenmanagement. 3. Aufl. 2007.
- Kilger, W., Pampel, J., Vikas, K. Flexible Plankostenrechnung und Deckungsbeitragsrechnung , 11. Aufl. 2002.

Remarks
The examination will be offered latest until summer term 2015 (repeaters only).

Course: Inverse Problems [01052]

Coordinators: T. Arens, F. Hettlich, A. Kirsch, A. Rieder
Part of the modules: Inverse Problems (p. 59)[MATHMWNM06]

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

Learning Control / Examinations

Conditions
None.

Recommendations
It is recommended to attend the following modules previously:
Linear Algebra 1+2
Analysis 1-3
Functional Analysis

Learning Outcomes
The students

- are able to discern well-posed from ill-posed problems,
- know regularization strategies.

Content

- linear equations of the first kind
- ill-posed problems
- theory of regularization
- iterative methods
- applications

Course: Classical Methods for Partial Differential Equations [KMPD]

Coordinators: D. Hundertmark, T. Lamm, M. Plum, W. Reichel, J. Rottmann-Matthes, R. Schnaubelt, L. Weis
Part of the modules: Classical Methods for Partial Differential Equations (p. 41)[MATHMWAN08]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Knowledge Discovery [2511302]

Coordinators: R. Studer
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Winter term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following §4, Abs. 2, 1 of the examination regulation.
Students can be awarded a bonus on their final grade if they successfully complete special assignments.

Conditions
None.

Learning Outcomes
Students

- know fundamentals of Machine Learning, Data Mining and Knowledge Discovery
- are able to design, train and evaluate adaptive systems
- conduct Knowledge Discovery projects in regards to algorithms, representations and applications.

Content
The lecture provides an overview of machine learning and data mining techniques for knowledge discovery from large data sets. These techniques are examined in respect of algorithms, applicability to different data representations and application in the real world.Topics of the lectures comprise the whole Machine Learning and Data Mining process like CRISP, data warehousing, OLAP-techniques, learning algorithms, visualization and empircial evaluation. Covered learning techniques range from traditional approaches like decision trees, neural networks and support vector machines to selected approaches resulting from current research. Discussed learning problems are amongst others feauturevector-based learning, text mining and social network analysis.

Media
Slides.

Basic literature

- T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning: Data Mining, Inference, and Prediction (http://www-stat.stanford.edu/ tibs/ElemStatLearn/)
- T. Mitchell. Machine Learning. 1997
- M. Berhold, D. Hand (eds). Intelligent Data Analysis - An Introduction. 2003
- P. Tan, M. Steinbach, V. Kumar: Introduction to Data Mining, 2005, Addison Wesley

Course: Combinatorics [MATHAG37]

Coordinators: M. Axenovich, T. Ueckerdt
Part of the modules: Combinatorics (p. 38)[MATHAG37]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Summer term	

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Combinatorics in the plane [MATHAG28]

Coordinators: M. Axenovich, T. Ueckerdt
Part of the modules: Combinatorics in the plane (p. 32)[MATHAG28]

ECTS Credits	Hours per week	Term	Instruction language
7	3/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Convex Analysis [2550120]

Coordinators: O. Stein
Part of the modules: Mathematical Programming (p. 132)[MATHMWOR9]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1		de

Learning Control / Examinations
The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation.
The examination is held in the semester of the lecture and in the following semester.
Prerequisite for admission to the written examination is attaining at least 30% of the exercise points. Therefore the online-registration for the written examination is subject to fulfilling the prerequisite.

Conditions
None.

Recommendations
It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

Learning Outcomes
The student

- knows and understands the fundamentals of convex analysis,
- is able to choose, design and apply modern techniques of convex analysis in practice.

Content
Convex Analysis deals with properties of convex functions and convex sets, in particular with respect to the minimization of convex functions over convex sets. That the involved functions are not necessarily assumed to be differentiable allows a number a applications which are not covered by techniques from smooth optimization, e.g. approximation problems with respect to the Manhattan or maximum norms, classification problems or the theory of statistical estimates. The lecture develops along another, geometrically simple example, where a nonsmooth obstacle set is to be described by a single smooth convex constraint such that minimal and maximal distances to the obstacle can be computed. The lecture is structured as follows:

- Introductory examples and terminology
- Convex subdifferential, Lipschitz continuity and the safety margin
- Normal cones, error bounds and the maximal distance

Media
Lecture notes.

Basic literature
Elective literature:

- J. Borwein, A. Lewis, Convex Analysis and Nonlinear Optimization: Theory and Examples (2 ed.), Springer, 2006.
- S. Boyd, L. Vandenberghe, Convex Optimization, Cambridge University Press, 2004.
- O. Güler, Foundations of Optimization, Springer, 2010.
- J.-B. Hiriart-Urruty, C. Lemarechal, Fundamentals of Convex Analysis, Springer, 2001.
- R.T. Rockafellar, Convex Analysis, Princeton University Press, 1970.
- R.T. Rockafellar, R.J.B. Wets, Variational Analysis, Springer, Berlin, 1998.

Remarks
The lecture is offered irregularly. The curriculum of the next three years is available online (www.ior.kit.edu).

Course: Convex Geometry [1044]

Coordinators: D. Hug
Part of the modules: Convex Geometry (p. 25)[MATHMWAG07]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Recommendations
It is recommended to attend the following modules previously:
Linear Algebra 1+2
Analysis 1-3

Learning Outcomes
The students

- know fundamental properties of convex sets and convex functions and apply these to related problems,
- are familiar with fundamental geometric and analytic inequalities and their applications to geometric extremal problems,
- know selected integral formulas for convex sets and the required results on invariant measures.

Content
. Convex Sets
1.1. Combinatorial Properties
1.2. Support and Separation Properties
1.3. Extremal Representations
2. Convex Functions
2.1. Basic Properties
2.2. Regularity
2.3. Support Function
3. Brunn-Minkowski Theory
3.1. Hausdorff Metric
3.2. Volume and Surface Area
3.3. Mixed Volumes
3.4. Geometric Inequalities
3.5. Surface Area Measures
3.6. Projection Functions
4. Integralgeometric Formulas
4.1. Invariant Measures
4.2. Projection and Section Formulas

Course: Hospital Management [2550493]

Coordinators: S. Nickel, Hansis
Part of the modules: Operations Research in Supply Chain Management and Health Care Management (p. 130)[MATHMWOR8]

ECTS Credits	Hours per week	Term	Instruction language
3	2/0	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists of attendance, a seminar thesis and a final exam (according to §4(2), 1 of the examination regulation). The examination is held in the term of the lecture and the following lecture.

Conditions
See German version.

Learning Outcomes
The student

- understands the principles of work flows in hospitals,
- utilizes Operations Research methods in so-called non-profit-organisations to improve service qualities,
- explains, classifies and deals with the most important application areas for mathematical models, e.g. personnel planning or quality management.

Content
The lecture “Hospital management“ presents internal organization structures, work conditions and work environments at the example of hospitals und relates this to common and expected conditions of other service industries.
Covered topics include normative environment, intra-organizational structure, personnel management, quality, external networking and market appearance. Students have the possibility to participate in a final exam.

Remarks
The lecture is held in every semester.
The planned lectures and courses for the next three years are announced online.

Course: Credit Risk [2530565]

Coordinators: M. Uhrig-Homburg
Part of the modules: Finance 2 (p. 110)[MATHMWBWLFBV2], Finance 3 (p. 111)[MATH4BWLFBV11]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes
The objective of this course is to become familiar with the credit markets and the credit risk indicators like ratings, default probabilities and credit spreads. The students learn about the components of credit risk (e.g. default time and default rate) and quantify these in different theoretical models to price credit derivatives.

Content
The lecture deals with the diverse issues arising in the context of measuring and controlling credit risk. At first, the theoretical and empirical relations between ratings, probabilities of default, and credit spreads are analysed. After that, the focus is on the valuation of credit risk. Finally, the management of credit risk, e.g. using credit derivatives and credit portfolio analysis, is examined, and the legal framework and its implications are discussed

Basic literature

- Lando, D., Credit risk modeling: Theory and Applications, Princeton Univ. Press, (2004).
- Uhrig-Homburg, M., Fremdkapitalkosten, Bonitätsrisiken und optimale Kapitalstruktur, Beiträge zur betriebswirtschaftlichen Forschung 92, Gabler Verlag, (2001).

Elective literature:

- Bluhm, C., Overbeck, L., Wagner, C. , Introduction to Credit Risk Modelling, 2nd Edition, Chapman & Hall, CRC Financial Mathematics Series, (2010).
- Duffie, D., Singleton, K.J., Credit Risk: Pricing, Measurement and Management, Princeton Series of Finance, Prentice Hall, (2003).

Course: Management of IT-Projects [2511214]

Coordinators: R. Schätzle
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Summer term	de

Learning Control / Examinations
The assessment of this course is a written examination (60 min) in the first week after lecture period according to Section 4(2), 1 of the examination regulation.

Conditions
None.

Learning Outcomes
Students

- explain the terminology of IT project management and typical used methods for planning, handling and controlling,
- apply methods appropiate to current project phases and project contexts,
- consider organisational and social impact factors.

Content
The lecture deals with the general framework, impact factors and methods for planning, handling, and controlling of IT projects. Especially following topics are addressed:

- project environment
- project organisation
- project planning including the following items:
  - plan of the project structure
  - flow chart
  - project schedule
  - plan of resources
- effort estimation
- project infrastructur
- project controlling
- risk management
- feasibility studies
- decision processes, conduct of negotiations, time management.

Media
Slides, access to internet resources.

Basic literature

- B. Hindel, K. Hörmann, M. Müller, J. Schmied. Basiswissen Software-Projektmanagement. dpunkt.verlag 2004
- Project Management Institute Standards Committee. A Guide to the Project Management Body of Knowledge (PMBoK guide). Project Management Institute. Four Campus Boulevard. Newton Square. PA 190733299. U.S.A.

Further literature is given in each lecture individually.

Course: IT Complexity in Practice [2511404]

Coordinators: D. Seese, Kreidler
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Winter term	de

Learning Control / Examinations
see German version.

Conditions
see German version.

Learning Outcomes
see German version.

Content
see German version

Basic literature
Elective literature:
Will be announced in the lecture.

Course: Marketing Strategy Business Game [2571176]

Coordinators: M. Klarmann, Mitarbeiter
Part of the modules: Marketing Management (p. 115)[MATHMWBWLMAR5]

ECTS Credits	Hours per week	Term	Instruction language
1,5	1	Summer term	de

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
Students
- are able to operate the strategic marketing simulation software "Markstrat"
- are able to take strategic marketing decisions in groups
- know how to apply strategic marketing concepts to practical contexts (e.g. for market segmentation, product launches, coordination of the marketing mix, market research, choice of the distribution channel or competitive behavior)
- are capable to collect and to select information usefully with the aim of decision-making
- are able to react appropriately to predetermined market conditions
- know how to present their strategies in a clear and consistent way
- are able to talk about the success, problems, critical incidents, external influences and strategy changes during the experimental game and to reflect and present their learning success

Content
Using Markstrat, a marketing strategy business game, students work in groups representing a company that competes on a simulated market against the other groups' companies.

Remarks
For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).

Course: Markov Decision Processes [MATHST11]

Coordinators: N. Bäuerle
Part of the modules: Markov Decision Processes (p. 95)[MATHMWST11]

ECTS Credits	Hours per week	Term	Instruction language
5	2/2	Winter / Summer Term	

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Market Research [2571150]

Coordinators: M. Klarmann
Part of the modules: Marketing Management (p. 115)[MATHMWBWLMAR5]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

Conditions
Please note that this course has to be completed successfully by students interested in seminar or master thesis positions at the chair of marketing.

Learning Outcomes
Topics addressed in this course are for example:

Theoretical priciples of market research
Statistical foundations of market research
Measuring customer attitudes
Understanding of customer reactions
Strategical decision making

Content
Topics addressed in this course are for example:

- Theoretical foundations of market research
- Statistical foundations of market research
- Measuring customer attitudes
- Understanding customer reactions
- Strategical decision making

Remarks
For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).

Course: Market Microstructure [2530240]

Coordinators: T. Lüdecke
Part of the modules: Finance 3 (p. 111)[MATH4BWLFBV11], Finance 2 (p. 110)[MATHMWBWLFBV2]

ECTS Credits	Hours per week	Term	Instruction language
3	2/0	Winter term	de

Learning Control / Examinations

Conditions
Knowledge of the content of the course *Asset Pricing* [2530555] is assumed.

Learning Outcomes
This lecture makes students familiar with the fundamental models of trading in financial markets. It starts with generic design features of financial markets which are used to frame price discovery as the key element of the trading process. The link between market design and market quality is pointed out by using alternative measures of market quality. Seminal models of market microstructure are used to show how dealer inventoy and/or asymmetric information affect market prices and the pricing of securities. Theoretical models are shown to provide predictions which are consistent with empiricial evidence.

Content
The focus of this lecture is on the question how the microstructure of financial markets affects price discovery and market quality. First, issues in designing market structure are presented and linked to fundamental dimensions of market quality, i.e liquidity and trading costs. In particular, the services and privileges of market makers are stressed. The main part of the lecture covers inventory-models of dealer markets and models of information-based trading. The final part gives attention to some econometric models to analyze the short-term behavior of security prices.

Media
Slides.

Basic literature
keine

Elective literature:
See reading list.

Remarks
This lecture will not be provided any more. The examination will be offered latest until winter term 2015/2016 (repeaters only).

Course: Mathematical methods in signal and image processing [MATHNM16]

Coordinators: A. Rieder
Part of the modules: Mathematical methods in signal and image processing (p. 67)[MATHMWNM16]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Mathematical modelling und simulation in practise [MATHNM27]

Coordinators: G. Thäter
Part of the modules: Mathematical modelling und simulation in practise (p. 73)[MATHNM27]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	Winter / Summer Term	en

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Mathematical Statistics [MATHST15]

Coordinators: N. Henze, B. Klar
Part of the modules: Mathematical Statistics (p. 99)[MATHMWST15]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Mathematical Theory of Democracy [25539]

Coordinators: A. Melik-Tangyan
Part of the modules: Collective Decision Making (p. 122)[MATHMW4VWL16]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	

Learning Control / Examinations
The assessment consists of a written exam (120 min.) according to §4 (2), 1 of the examination regulation. It may be an oral exam (20 - 30 min.) (according to §4 (2), 2 of the examination regulation) in the case of poor attendance.

Conditions
None.

Recommendations
None.

Learning Outcomes
The student understands the foundations of democracy and the implementation problems and the masters the operationalization of the problems by mathematical models

Content
The mathematical theory of democracy deals with the selection of representatives who make decisions on behalf of the whole society. The concept of representation is operationalized with the popularity index (average percentage of the population represented on a number of issues), and with the universality index (percentage of cases when a majority of the population is represented). With these indexes, the characteristics of individual representatives (president, dictator) and representative bodies (parliament, coalition, cabinet, council, jurors) are investigated. To bridge the representative and direct democracies, an alternative election method is proposed, which is not based on voting, but on the indexing of the candidates with regard to the political profile of the electorate. In addition, societal applications (federal election, surveys) and non-social applications (multi-criteria decisions, finances, traffic control) are considered.

Media
PowerPoint

Basic literature
Tangian, Andranik (2013) Mathematical Theory of Democracy. Springer, Berlin-Heidelberg

Course: Functions of matrices [MATHNM39]

Coordinators: V. Grimm
Part of the modules: Functions of matrices (p. 83)[MATHNM39]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Maxwell's Equations [MATHAN28]

Coordinators: T. Arens, F. Hettlich, A. Kirsch
Part of the modules: Maxwell's Equations (p. 52)[MATHMWAN28]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Modeling Strategic Decision Making [2577908]

Coordinators: H. Lindstädt
Part of the modules: Strategic Corporate Management and Organization (p. 114)[MATHMWUO1]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2	Summer term	de

Learning Control / Examinations
Written exam 100% following §4, Abs. 2.

Conditions
None.

Learning Outcomes
After passing this course students are able to

- discuss individual decisions under multiple goals and subjective expected utility theory.
- handle group decisions.
- assess the implications of asymmetric information and conflicting goals (Agency Theory) on the design of decision tasks
- recognize limits of the basic models and of the expected utility theory.
- illustrate and explain advancements in subjective expected utility theory.

Content
Starting from the basic model of economic decision theory, fundamental decision principles and calculi for multi-attribute decisions in certain and uncertain conditions up to subjective expected utility theory and the economic assessment of information are described. Subsequently participants will become familiar with agency-theoretical approaches and models for the function and design of organizational information and decision-making systems. To confront numerous infringements by decision-makers against principles and axioms of this calculus, in addition non-expected utility calculi and advanced models for decisions by economic agents are discussed; these are especially important for management decisions.

Media
Slides.

Basic literature

- Eisenführ, F.; Weber, M.: *Rationales Entscheiden*. Springer, 4. Aufl. Berlin 2003.[1]
- Laux, H.: Entscheidungstheorie. Springer, 6. Aufl. Berlin 2005.[2]
- Lindstädt, H: *Entscheidungskalküle jenseits des subjektiven Erwartungsnutzens*. In: Zeitschrift für betriebswirtschaftliche Forschung 56 (September 2004), S. 495 - 519.

Course: Business Process Modelling [2511210]

Coordinators: A. Oberweis
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Winter term	de

Learning Control / Examinations
The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation in the first week after lecture period.

Conditions
None.

Learning Outcomes
Students

- describe goals of business process modeling and aplly different modeling languages,
- choose the appropriate modeling language according to a given context,
- use suitable tools for modeling business processes,
- apply methods for analysing and assessing process modells to evaluate specific quality characteristics of the process model.

Content
The proper modeling of relevant aspects of business processes is essential for an efficient and effective design and implementation of processes. This lecture presents different classes of modeling languages and discusses the respective advantages and disadvantages of using actual application scenarios. For that simulative and analytical methods for process analysis are introduced. In the accompanying exercise the use of process modeling tools is practiced.

Media
Slides, access to internet resources.

Basic literature
M. Weske: Business Process Management: Concepts, Languages, Architectures. Springer 2012.
F. Schönthaler, G.Vossen, A. Oberweis, T. Karl: Business Processes for Business Communities: Modeling Languages, Methods, Tools. Springer 2012.
Further Literature will be given in the lecture.

Course: Modelling, Measuring and Managing of Extreme Risks [2530355]

Coordinators: U. Werner, S. Hochrainer
Part of the modules: Insurance Management I (p. 112)[MATHMWBWLFBV6]

ECTS Credits	Hours per week	Term	Instruction language
2,5	2	Summer term	de

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Recommendations
None.

Learning Outcomes
See German version.

Content

- Risk preferences under uncertainty, risk management strategies using utility functions, risk aversion, premium calculations, insurance principle, exceptions, Arrow Lind theorem. Probability and statistics introduction, distributions, Lebesgue integration.
- Introduction to Extreme value theory, Catastrophe models: Introduction to extreme value theory, asymptotic models, extremal types theorem, Generalized extreme value distributions, max-stability, domain of attraction inference for the GEV distribution, model generalization: order statistics. Catastrophemodelapproaches, simulationof extremes.
- Threshold models, generalized pareto distribution, threshold selection, parameter estimation, point process characterization, estimation under maximum domain: Pickands's estimator, Hill's estimator, Deckers-Einmahl-de Haan estimator.
- Catastrophe model approaches, simulation of earthquakes, hurricanes, and floods, vulnerability functions, loss estimation. Indirectvsdirecteffects.
- Introduction to financial risk management against rare events. Basic risk measures: VaR, CVar, CEL and current approaches. Risk management measures against extreme risk for different risk bearers: Insurance principle, loading factors, credits, reserve accumulation, risk aversion.
- Risk preferences in decision making processes. Utility theory, certainty equivalent, Arrow Lind proof for risk neutrality, exceptions in risk neutrality assumptions.
- The Fiscal Risk Matrix, Fiscal Hedge Matrix, Dealing with Risk in Fiscal Analysis and Fiscal Management (macroeconomic context, specific fiscal risks, institutional framework). Reducing Government Risk Exposure (Risk mitigation with private sector, Risk transfer and risk-sharing mechanisms, Managing residual risk).
- Approaches to Managing Fiscal Risk (Reporting on financial statements, Cost-based budgeting, Rules for talking fiscal risk, Market-type arrangements). Case: Analyzing Government Fiscal Risk Exposure in China (Krumm/Wong), The Fiscal Risk of Floods: Lessons of Argentina (AlciraKreimer).
- Case study presentations: Household level index based insurance systems (India, Ethiopia, SriLanka, China), insurance back-up systems coupled with public private partnerships (France, US), Reinsurance approaches (Munich Re, Swiss Re, Allianz).
- Climate Change topics: IPCC report, global and climate change.

Basic literature

- Woo G (2011) Calculating Catastrophe. Imperial College Press, London, U.K.
- Grossi P and Kunreuther H (eds.) (2005) Catastrophe Modeling: A New Approach to Managing Risk. New York, Springer.
- Embrechts P, Klüppelberg C, Mikosch, T (2003) ModellingExtremal Events for Insurance and Finance. Springer,New York(corr. 4th printing, 1st ed. 1997).
- Wolke, T. (2008). Risikomanagement. Oldenbourg, Muenchen.
- Klugman, A.S, Panjer, H.H, and Willmot, G.E. (2008) Loss Models: From Data to Decisions. 3rd edition. Wiley, New York.
- Slavadori G, Michele CD, Kottegoda NT and Rosso R (2007) Extremes in Nature: An Approach Using Copulas. Springer, New York.
- Amendola et al. (2013) (eds.): *Integrated Catastrophe Risk Modeling. Supporting Policy Processes.* Advances in Natural and Technological Hazards Research, New York, Springer,
- Hochrainer, S. (2006). Macroeconomic Risk Management against Natural Disasters. *German University Press (DUV)*, Wiesbaden, Germany.

Course: Multivariate Methods [2520317]

Coordinators: W. Heller
Part of the modules: Statistical Methods in Risk Management (p. 125)[MATHMW4STAT2]

ECTS Credits	Hours per week	Term	Instruction language
5	2/2	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Basic literature

- Fahrmeir L., Hamerle A., Tut G.: Multivariate statistische Verfahren; de Gruyter 1996
- Jobson J.D.: Applied Multivariate Data Analysis Vol. I/II, Springer 1991
- Dobson A.J.: An Introduction to Statistical Modelling, Chapman and Hall
- Hosmer D.W., Lemeshow S.: Applied Logistic Regression, J. Wiley 1989
- Jambu M.: Explorative Datenanalyse, G. Fischer 1992

Course: Nature-inspired Optimisation Methods [2511106]

Coordinators: P. Shukla
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Summer term	en

Learning Control / Examinations
The assessment consists of a written exam (60 min) (according to Section 4(2), 1 of the examination regulation) and an additional written examination called "bonus exam", 60 min (according Section 4(2), 3 of the examination regulation) or a selection of exersices . The bonus exam may be split into several shorter written tests.
The grade of this course is the achieved grade in the written examination. If this grade is at least 4.0 and at most 1.3, a passed bonus exam will improve it by one grade level (i.e. by 0.3 or 0.4).

Conditions
None.

Learning Outcomes
To learn:

1. Different nature-inspired methods: local search, simulated annealing, tabu search, evolutionary algorithms, ant colony optimization, particle swarm optimization
2. Different aspects and limitation of the methods
3. Applications of such methods
4. Multi-objective optimization methods
5. Constraint handling methods
6. Different aspects in parallelization and computing platforms

Content
Many optimization problems are too complex to be solved to optimality. A promising alternative is to use stochastic heuristics, based on some fundamental principles observed in nature. Examples include evolutionary algorithms, ant algorithms, or simulated annealing. These methods are widely applicable and have proven very powerful in practice. During the course, such optimization methods based on natural principles are presented, analyzed and compared. Since the algorithms are usually quite computational intensive, possibilities for parallelization are also investigated.

Media
Powerpoint slides with annotations on graphics screen, access to Internet resources, recorded lectures

Basic literature
F. Glover and M. Laguna. „Tabu Search" In: Handbook of Applied Optimization, P. M. Pardalos and M. G. C. Resende (Eds.), Oxford University Press, pp. 194-208, 2002. G. Raidl and J. Gottlieb: Empirical Analysis of Locality, Heritability and Heuristic Bias in Evolutionary Algorithms: A Case Study for the Multidimensional Knapsack Problem. Evolutionary Computation, MIT Press, 13(4), pp. 441-475, 2005.
Weiterführende Literatur:
E. L. Aarts and J. K. Lenstra: „Local Search in Combinatorial Optimization". Wiley, 1997. D. Corne and M. Dorigo and F. Glover: „New Ideas in Optimization". McGraw-Hill, 1999. C. Reeves: „Modern Heuristic Techniques for Combinatorial Optimization". McGraw-Hill, 1995. Z. Michalewicz, D. B. Fogel: „How to solve it: Modern Heuristics". Springer, 1999. E. Bonabeau, M. Dorigo, G. Theraulaz: „Swarm Intelligence". Oxford University Press, 1999. A. E. Eiben and J. E. Smith: „Introduction to Evolutionary Computing". Springer, 2003. K. Weicker: „Evolutionäre Algorithmen". Teubner, 2002. M. Dorigo, T. Stützle: „Ant Colony Optimization". MIT Press, 2004. K. Deb: „Multi-objective Optimization using Evolutionary Algorithms", Wiley, 2003.

Course: Nonlinear Optimization I [2550111]

Coordinators: O. Stein
Part of the modules: Stochastic Methods and Simulation (p. 129)[MATHMWOR7], Methodical Foundations of OR (p. 128)[MATHMWOR6], Mathematical Programming (p. 132)[MATHMWOR9]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	de

Learning Control / Examinations
The assessmentconsits of a written exam (60 minutes) according to Section 4(2), 1 of the examination regulation.
The exam takes place in the semester of the lecture and in the following semester.
Prerequisite for admission to the written examination is attaining at least 50% of the exercise points. Therefore the online-registration for the written examination is subject to fulfilling the prerequisite.
The examination can also be combined with the examination of *Nonlinear Optimization II* [2550113]. In this case, the duration of the written examination takes 120 minutes.

Conditions
None.

Learning Outcomes
The student

- knows and understands fundamentals of unconstrained nonlinear optimization,
- is able to choose, design and apply modern techniques of unconstrained nonlinear optimization in practice.

Content
The lecture treats the minimization of smooth nonlinear functions under nonlinear constraints. For such problems, which occur very often in economics, engineering, and natural sciences, we derive optimality conditions that form the basis for numerical solution methods. The lecture is structured as follows:

- Introduction, examples, and terminology
- Existence results for optimal points
- First and second order optimality condtions for unconstrained problems
- Optimality conditions for unconstrained convex problems
- Numerical methods for unconstrained problems (line search, steepest descent method, variable metric methods, Newton method, Quasi Newton methods, CG method, trust region method)

Constrained problems are the contents of part II of the lecture.
The lecture is accompanied by computer exercises in which you can learn the programming language MATLAB and implement and test some of the methods for practically relevant examples.

Media
Lecture notes.

Basic literature
Elective literature:

- W. Alt, Nichtlineare Optimierung, Vieweg, 2002
- M.S. Bazaraa, H.D. Sherali, C.M. Shetty, Nonlinear Programming, Wiley, 1993
- O. Güler, Foundations of Optimization, Springer, 2010
- H.Th. Jongen, K. Meer, E. Triesch, Optimization Theory, Kluwer, 2004
- J. Nocedal, S. Wright, Numerical Optimization, Springer, 2000

Remarks
Part I and II of the lecture are held consecutively in the *same* semester.

Course: Nonlinear Optimization II [2550113]

Coordinators: O. Stein
Part of the modules: Methodical Foundations of OR (p. 128)[MATHMWOR6], Mathematical Programming (p. 132)[MATHMWOR9]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (120 minutes) according to §4(2), 1 of the examination regulation.
The exam takes place in the semester of the lecture and in the following semester.
Prerequisite for admission to the written examination is attaining at least 50% of the exercise points. Therefore the online-registrationfor the written examination is subject to fulfilling the prerequisite.
The exam can also be combined with the examination of *Nonlinear Optimization I* [2550111]. In this case, the duration of the written exam takes 120 minutes.

Conditions
None.

Learning Outcomes
The student

- knows and understands fundamentals of constrained nonlinear optimization,
- is able to choose, design and apply modern techniques of constrained nonlinear optimization in practice.

Content
The lecture treats the minimization of smooth nonlinear functions under nonlinear constraints. For such problems, which occur very often in economics, engineering, and natural sciences, we derive optimality conditions that form the basis for numerical solution methods. Part I of the lecture treats unconstrained optimization problems. Part II of the lecture is structured as follows:

- Topology and first order approximations of the feasible set
- Theorems of the alternative, first and second order optimality conditions for constrained problems
- Optimality conditions for constrained convex problems
- Numerical methods for constrained problems (penalty method, multiplier method, barrier method, interior point method, SQP method, quadratic optimization)

The lecture is accompanied by computer exercises in which you can learn the programming language MATLAB and implement and test some of the methods for practically relevant examples.

Media
Lecture notes.

Basic literature
Elective literature:

- W. Alt, Nichtlineare Optimierung, Vieweg, 2002
- M.S. Bazaraa, H.D. Sherali, C.M. Shetty, Nonlinear Programming, Wiley, 1993
- O. Güler, Foundations of Optimization, Springer, 2010
- H.Th. Jongen, K. Meer, E. Triesch, Optimization Theory, Kluwer, 2004
- J. Nocedal, S. Wright, Numerical Optimization, Springer, 2000

Remarks
Part I and II of the lecture are held consecutively in the *same* semester.

Course: Nonparametric Statistics [MATHST16]

Coordinators: N. Henze, B. Klar
Part of the modules: Nonparametric Statistics (p. 100)[MATHMWST16]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Numerical continuation methods [MATHNM42]

Coordinators: J. Rottmann-Matthes
Part of the modules: Numerical continuation methods (p. 86)[MATHNM42]

ECTS Credits	Hours per week	Term	Instruction language
5	2/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Numerical methods for differential equations [NMDG]

Coordinators: W. Dörfler, M. Hochbruck, T. Jahnke, A. Rieder, C. Wieners
Part of the modules: Numerical methods for differential equations (p. 57)[MATHMWNM03]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Numerical methods for hyperbolic equations [MATHNM28]

Coordinators: W. Dörfler
Part of the modules: Numerical methods for hyperbolic equations (p. 75)[MATHNM28]

ECTS Credits	Hours per week	Term	Instruction language
6	3/1	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Numerical Methods for Integral Equations [MATHNM29]

Coordinators: T. Arens, F. Hettlich, A. Kirsch
Part of the modules: Numerical Methods for Integral Equations (p. 74)[MATHNM29]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Numerical methods for time-dependent partial differential equations [MATHNM20]

Coordinators: M. Hochbruck, T. Jahnke
Part of the modules: Numerical methods for time-dependent partial differential equations (p. 70)[MATHMWNM20]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Numerical methods in computational electrodynamics [MATHNM13]

Coordinators: W. Dörfler, M. Hochbruck, T. Jahnke, A. Rieder, C. Wieners
Part of the modules: Numerical methods in computational electrodynamics (p. 64)[MATHMWNM13]

ECTS Credits	Hours per week	Term	Instruction language
6	3/1	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Numerical Methods in Solid Mechanics [MATHNM12]

Coordinators: C. Wieners
Part of the modules: Numerical Methods in Solid Mechanics (p. 63)[MATHMWNM12]

ECTS Credits	Hours per week	Term	Instruction language
8	4+2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Numerical Methods in Mathematical Finance [MATHNM18]

Coordinators: T. Jahnke
Part of the modules: Numerical Methods in Mathematical Finance (p. 68)[MATHMWNM18]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Numerical methods in mathematical finance II [MATHNM26]

Coordinators: T. Jahnke
Part of the modules: Numerical methods in mathematical finance II (p. 72)[MATHNM26]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Numerical optimisation methods [MATHNM25]

Coordinators: W. Dörfler, M. Hochbruck, T. Jahnke, A. Rieder, C. Wieners
Part of the modules: Numerical optimisation methods (p. 71)[MATHMWNM25]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Numerical methods for Maxwell's equations [MATHNM33]

Coordinators: T. Jahnke
Part of the modules: Numerical methods for Maxwell's equations (p. 79)[MATHNM33]

ECTS Credits	Hours per week	Term	Instruction language
6	3/1	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Open Innovation – Concepts, Methods and Best Practices [2571199]

Coordinators: A. Hahn
Part of the modules: Marketing Management (p. 115)[MATHMWBWLMAR5]

ECTS Credits	Hours per week	Term	Instruction language
1,5	1/0	Summer term	en

Learning Control / Examinations
Non exam assessment (presentation) (following §4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
Students

- know approaches, objectives, advantages and disadvantages of Open Innovation,
- know strategy, processes, methods and fields of application of Open Innovation,
- understand success factors by means of best practices from real life projects,
- can apply Open Innovation methods on their own.

Content
Joy's Law: "No matter who you are, most of the smartest people work for someone else" (Bill Joy, Co-Founder Sun Microsystems)
This lecture conveys an understanding and practical application of Open Innovation, i.e. the collaborative opening of the innovation process to customers, suppliers, partners, competitors, new markets. . . . The contents encompass among others:

- approaches, objectives, advantages and disadvantages of Open Innovation
- knowledge of approaches, objectives, advantages and disadvantages of Open Innovation
- strategy, processes, methods and fields of application of Open Innovation
- focus mainly on customer integration into the innovation process (e.g. Netnography, Crowdsourcing, Lead User, Trend Receiver,. . .)
- Understanding of success factors by means of best practices from real life projects (Digital Open Innovation, Idea Contests, Ideation, Hackathons, Idea Management, Customer Engagement, Lead User, Trend Receiver,. . .)
- Independent application of Open Innovation methods.

Basic literature
To be announced in the course.

Remarks
For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).
Please note that only one of the following courses can be chosen in the Marketing Management Module: Marketing Strategy Business Game, Strategic Brand Management, Open Innovation – Concepts, Methods and Best Practices or Business Plan Workshop.

Course: Operations Research in Health Care Management [2550495]

Coordinators: S. Nickel
Part of the modules: Operations Research in Supply Chain Management and Health Care Management (p. 130)[MATHMWOR8]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter / Summer Term	en

Learning Control / Examinations
The assessment is a 120 minutes written examination (according to §4(2), 1 of the examination regulation).
The examination is held in the term of the lecture and the following lecture.

Conditions
Basic knowledge as conveyed in the module *Introduction to Operations Research* [WI1OR] is assumed.

Learning Outcomes
The student

- knows applications of basic and advanced methods of Operations Research applied to health services,
- gains the ability to use quantitative models for the operations planning and logistics in a hospital environment, e.g. appointment, transportation, operating room planning or nurse rostering as well as inventory management and layout planning
- describes the advantages and benefits of simulation models and OR methods to plan home health care services,
- applies the introduced methods in detail in practical case studies.

Content
In the last years reforms of the German health system, e.g. the introduction of the G-DRG-system, have put an increasing cost pressure on hospitals. Therefore their target is to improve quality, transparency, and efficiency of hospital services, e.g. by reducing the length of stay of patients. To achieve this, processes have to be analyzed in order to optimize them if necessary. When looking at the targets of optimization not only efficiency but also quality of care and patient satisfaction (e.g. waiting times) have to be taken into account.
Besides hospitals also home health care services and their planning are discussed in this lecture. Because of the demographic development this is an emerging field in the health care sector. Here, e.g. nurse rosters have to be built which give details about which nurse visits which patient at what time. While doing so different targets have to be regarded, e.g. the continuity of nurse-patient relationship or the minimization of the distances the nurses have to travel.

Basic literature
Elective literature:

- Fleßa: Grundzüge der Krankenhausbetriebslehre, Oldenbourg, 2007
- Fleßa: Grundzüge der Krankenhaussteuerung, Oldenbourg, 2008
- Hall: Patient flow: reducing delay in healthcare delivery, Springer, 2006

Remarks
The lecture (former name "Operations Research in Health Care Management") is planned to be held in the summer term 2016.
The planned lectures and courses for the next three years are announced online.

Course: Operations Research in Supply Chain Management [2550480]

Coordinators: S. Nickel
Part of the modules: Operations Research in Supply Chain Management and Health Care Management (p. 130)[MATHMWOR8]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter / Summer Term	en

Learning Control / Examinations
The assessment is a 120 minutes written examination (according to §4(2), 1 of the examination regulation).
The examination is held in the term of the lecture and the following lecture.

Conditions
Basic knowledge as conveyed in the module *Introduction to Operations Research* [WI1OR] is assumed.

Recommendations
Advanced knowledge of Operations Research (e.g., as conveyed in the lectures *Facility Location and Strategic SCM*, *Tactical and operational SCM*) is recommended.

Learning Outcomes
The student

- knows and applies basic and advanced modeling techniques playing an important role in today's problem solving occurring in supply networks
- models problems with a mathematical approach to technical-economical problems, and derives optimal solutions,
- classifies problems both conceptually and mathematically by identifying central variables and parameters in a specific problem setting,
- evaluates current developments in operations research and supply chain management.

Content
Supply Chain Management constitutes a general tool for logistics process planning in supply networks. To an increasing degree quantitative decision support is provided by methods and models from Operations Research. The lecture "OR in Supply Chain Management" conveys concepts and approaches for solving practical problems and presents an insight to current research topics. The lecture's focus is set on modeling and solution methods for applications originating in different domains of a supply chain. The emphasis is put on mathematical methods like mixed integer programming, valid inequalities or column generation, and the derivation of optimal solution strategies.
In form and content, the lecture addresses all levels of Supply Chain Management: After a short introduction, the tactical and operational level will be discussed with regard to inventory models, scheduling as well as cutting and packing. The strategic level will be discussed in terms of layout planning. Another main focus of the lecture is the application of methods from online optimization. This optimization discipline has gained more and more importance in the optimization of supply chains over the several past years due to an increasing amount of dynamic data flows.

Basic literature

- Simchi-Levi, D.; Chen, X.; Bramel, J.: The Logic of Logistics: Theory, Algorithms, and Applications for Logistics and Supply Chain Management, 2nd edition, Springer, 2005
- Simchi-Levi, D.; Kaminsky, P.; Simchi-Levi, E.: Designing and Managing the Supply Chain: Concepts, Strategies, and Case Studies, McGraw-Hill, 2000
- Silver, E. A.; Pyke, D. F.; Peterson, R.: Inventory Management and Production Planning and Scheduling, 3rd edition, Wiley, 1998
- Blazewicz, J.: Handbook on Scheduling - From Theory to Applications, Springer, 2007
- Pinedo, M. L.: Scheduling - Theory, Algorithms, and Systems (3rd edition), Springer, 2008
- Dyckhoff, H.; Finke, U.: Cutting and Packing in Production and Distribution - A Typology and Bibliography, Physica-Verlag, 1992
- Borodin, A.; El-Yaniv, R.: Online Computation and Competitive Analysis, Cambridge University Press, 2005
- Francis, R. L.; McGinnis, L. F.; White, A.: Facility Layout and Location: An Analytical Approach, 2nd edition, Prentice-Hall, 1992

Remarks
The lecture is planned to be held in the winter term 2014/15. The planned lectures and courses for the next three years are announced online.

Course: Optimization in a Random Environment [25687]

Coordinators: K. Waldmann
Part of the modules: Stochastic Modelling and Optimization (p. 133)[MATHMWOR10]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1/2	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following Section 4(2), 1 of the examination regulation. Credit from the voluntary computer lab is accounted for in the overall grade raising the exam grade by a 2/3 step of a full grade (according to Section 4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
Students are enabled to apply their knowledge about techniques and methodology on current problems such as the measurement and evaluation of operational risk as required by the Basel II accord. Subject matter of the course will be announced in due time.

Content
The course is concerned with the quantitative analysis of selected problems arising in engineering and natural sciences. Subject matter of the course will be announced in due time.

Media
Blackboard, slides, flash-animations, java tools, simulation software.

Basic literature
- Lecture Notes
- Elective literature: problem-oriented

Remarks
The lecture is offered irregularly. The curriculum of the next two years is available online.

Course: Optimisation and optimal control for differential equations [MATHNM09]

Coordinators: W. Dörfler, M. Hochbruck, T. Jahnke, A. Rieder, C. Wieners
Part of the modules: Optimisation and optimal control for differential equations (p. 62)[MATHMWNM09]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: OR-oriented modeling and analysis of real problems (project) [25688]

Coordinators: K. Waldmann
Part of the modules: Stochastic Modelling and Optimization (p. 133)[MATHMWOR10]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1/2	Winter / Summer Term	de

Learning Control / Examinations
Presentation and documentation of the rssults.

Conditions
None.

Learning Outcomes
Students are enabled to apply their knowledge about techniques and methodology on real problems and to develop a practically oriented solution an an OR-lab; e.g. in the public health sector. Subject matter of the course will be announced in due time.

Content
The course is concerned with the quantitative analysis of selected problems arising in engineering and natural sciences. Subject matter of the course will be announced in due time.

Media
Blackboard, slides, flash-animations, java tools, simulation software.

Basic literature

- Lecture Notes
- Elective literature: problem -oriented.

Remarks
The lecture is offered irregularly. The curriculum of the next two years is available online.

Course: Organic Computing [2511104]

Coordinators: H. Schmeck, S. Mostaghim
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Summer term	en

Learning Control / Examinations
The assessment of this course consists of a written examination (60 min) (following §4(2), 1 SPO) and of submitting written exercises that recapitulate the content of the course. The exercises include theoretical questions as well as practical programming. For providing a successful solution to all exercises, a bonus will be granted, improving the grade of a passed exam by one grade-step (0.3 or 0.4, respectively, following §4(2), 3 SPO). The course will be offered every second semester (summer term) and exams may be repeated at every ordinary exam date.

Conditions
None.

Learning Outcomes
The student acquires the ability to master methods and concepts of Organic Computing and to demonstrate innovation skills regarding the used methods.
Therefore the course aims at the teaching of fundamentals and methods of Organic Computing within the context of its applicability in practice. On the basis of a fundamental understanding of the taught concepts and methods the students should be able to choose the adequate methods and concepts, if necessary further develop them according to the situation and use them properly when facing related problems in their later job. The students should be capable of finding arguments for the chosen solutions and express them to others.

Content
The mission of Organic Computing is to tame complexity in technical systems by providing appropriate degrees of freedom for self-organized behaviour adapting to changing requirements of the execution environment, in particular with respect to human needs. According to this vision an organic computer system should be aware of its own capabilities, the requirements of the environment, and it should be equipped with a number of “self-x” properties allowing for the anticipated adaptiveness and for a reduction in the complexity of system management. These self-x properties are self-organisation, self-configuration, self-optimization, self-healing, self-protection and self-explanation. In spite of these self-x properties, an organic system should be open to external control actions which might be necessary to prevent undesired behaviour.

Media
powerpoint slides with annotations using a tablet pc access to applets and Internet ressources lecture recording (camtasia).

Basic literature

- Autonomic Computing: Concepts, Infrastructure and Applications. M. Parashar and S. Hariri (Ed.), CRC Press. December 2006.
- Self-Organization in Biological Systems. S. Camazine, J. Deneubourg, N. R. Franks, J. Sneyd, G. Theraulaz and E. Bonabeau. Princeton University Press, 2003.
- Complex Adaptive Systems: An Introduction. H. G. Schuster, Scator Verlag, 2001.
- Introduction to Evolutionary Computing. A. E. Eiben and J. E. Smith. Natural Computing Series, Springer Verlag, 2003. Swarm Intelligence: From Natural to Artificial Systems.Eric Bonabeau, Marco Dorigo and Guy Theraulaz. Oxford University Press, 1999.
- Control of Complex Systems. K. Astrom, P. Albertos, M. Blanke, A. Isidori and W. Schaufelberger. Springer Verlag, 2001.

Elective literature:

- **Adaptive and Self-organising Systems,** Christian Müller-Schloer, Moez Mnif, Emre Cakar, Hartmut Schmeck, Urban Richter,
June 2007. Preprint.Submitted to ACM Transactions on Autonomous and Adaptive Systems (TAAS)
- **Organic Computing - Addressing Complexity by Controlled Self-organization,** Jürgen Branke, Moez Mnif, Christian Müller-Schloer, Holger Prothmann, Urban Richter, Fabian Rochner, Hartmut Schmeck, In Tiziana Margaria, Anna Philippou, and Bernhard Steffen, *Proceedings of ISoLA 2006*, pp. 200-206. Paphos, Cyprus, November 2006.
- Evolutionary Optimization in Dynamic Environments. J. Branke. Kluwer Academic Publishers, 2002.
- Self-star Properties in Complex Information Systems: Conceptual and Practical Foundations (Lecture Notes in Computer Science. O. Babaoglu, M. Jelasity, A. Montresor, C. Fetzer, S. Leonardi, A. van Moorsel and M. van Steen. Springer Verlag, 2005.

- Design and Control of Self-organizing Systems. C. Gershenson. PhD thesis, Vrije Universiteit Brussel, Brussels, Belgium, 2007.
- VDE / ITG / GI - Positionspapier: Organic Computing - Computer- und Systemarchitektur im Jahr 2010. Juli 2003. it - Information Technology, Themenheft Organic Computing, Oldenbourg Verlag. Volume: 47, Issue: 4/2005.

further references will be announced in class

Course: Managing Organizations [2577902]

Coordinators: H. Lindstädt
Part of the modules: Strategic Corporate Management and Organization (p. 114)[MATHMWUO1]

ECTS Credits	Hours per week	Term	Instruction language
3.5	2/0	Winter term	de

Learning Control / Examinations
The assessment will consist of a written exam (60 min) taking place at the beginning of the recess period (according to Section 4 (2), 2 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Learning Outcomes
After passing this course students are able to

- evaluate strengths and weaknesses of existing organisational structures and rules.
- compare alternatives of organisational structure in practice and assess and interpret them regarding their effectiveness and efficiency.
- assess the management of organisational changes.

Content
The course should enable the participants to assess the strengths and weaknesses of existing organisational structures and rules using systematic criteria. Here concepts and models for designing organisation structures, regulating organizational processes and managing organisational changes are presented and discussed using case studies. The course is structured to relate to actions and aims to give students a realistic view of the opportunities and limits of rational design approaches.

Media
Slides.

Basic literature

- Laux, H.; Liermann, F.: *Grundlagen der Organisation*, Springer. 6. Aufl. Berlin 2005.
- Lindstädt, H.: *Organisation*, in Scholz, C. (Hrsg.): Vahlens Großes Personallexikon, Verlag Franz Vahlen. 1. Aufl. München, 2009.
- Schreyögg, G.: *Organisation. Grundlagen moderner Organisationsgestaltung*, Gabler. 4. Aufl. Wiesbaden 2003.

The relevant excerpts and additional sources are made known during the course.

Remarks
The credits for the course “Managing Organizations” have been changed from 4 to 3,5 from summer term 2015 on.

Course: Organization Theory [2577904]

Coordinators: H. Lindstädt
Part of the modules: Strategic Corporate Management and Organization (p. 114)[MATHMWUO1]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam following §4, Abs. 2, 1 of the examination regulation.

Conditions
None.

Learning Outcomes
The participants are made familiar with mostly classical principles of economic organisational theory and institutional economics. This includes transaction cost theory and agency-theory approaches, models for the function and design of organisational information and decision-making systems, transfer price models to coordinate the exchange of goals and services within companies. The course therefore lays the basis for a deeper understanding of the advanced literature on this key economic area.

Content
Concretely, after passing this course the students should be able to assess effects and implications of the following aspects:

- Design of transactional relationships between different steps of the value-adding process
- Design of decision tasks under diverse aspects
- Organisation under asymmetric information and conflicting goals (agency theory)

Media
Folien.

Basic literature

- Laux, H.; Liermann, F.: Grundlagen der Organisation. Springer, 5. Aufl. Berlin 2003.
- Milgrom, P.; Roberts, J.: Economics, Organization and Management. Prentice Hall, Englewoods Cliffs 1992.

The relevant excerpts and additional sources are made known during the course.

Remarks
The course "Organization Theory" will not be offered any more from summer term 2015 on. The examination will be offered latest until winter term 2015/2016 (repeaters only).

Course: P&C Insurance Simulation Game [INSGAME]

Coordinators: U. Werner
Part of the modules: Insurance Management I (p. 112)[MATHMWBWLFBV6]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
See German version.

Content

Course: Parallel computing [MATHNM08]

Coordinators: C. Wieners
Part of the modules: Parallel computing (p. 61)[MATHMWNM08]

ECTS Credits	Hours per week	Term	Instruction language
5	2/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Parametric Optimization [2550115]

Coordinators: O. Stein
Part of the modules: Mathematical Programming (p. 132)[MATHMWOR9]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1		de

Learning Control / Examinations
The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation.
The examination is held in the semester of the lecture and in the following semester.
Prerequisite for admission to the written examination is attaining at least 30% of the exercise points. Therefore the online-registration for the written examination is subject to fulfilling the prerequisite.

Conditions
None.

Recommendations
It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

Learning Outcomes
The student

- knows and understands the fundamentals of parametric optimization,
- is able to choose, design and apply modern techniques of parametric optimization in practice.

Content
Parametric Optimization deals with the impact of parameter changes on the solution of optimization problems. In practical applications this is of fundamental importance, for example, to assess the quality of a numerically computed solution or to derive quantative statements about its parameter dependence. Moreover, many optimization algorithms are controlled by variing parameters, and applications may be found in noncooperative game theory, geometric optimization and robust optimization. The lecture provides a mathematically sound introduction to these topics and is structured as follows:

- Introductory examples and terminology
- Stability and regularity conditions
- Sensitivity
- Applications: semi-infinite optimization and Nash games

Media
Lecture notes.

Basic literature
Elective literature:

- J.F. Bonnans, A. Shapiro, Perturbation Analysis of Optimization Problems, Springer, New York, 2000.
- W. Dinkelbach, Sensitivitätsanalysen und parametrische Programmierung, Springer, Berlin, 1969.
- J. Guddat, F. Guerra Vasquez, H.Th. Jongen, Parametric Optimization: Singularities, Pathfollowing and Jumps, Wiley, Chichester, and Teubner, Stuttgart, 1990.
- R.T. Rockafellar, R.J.B. Wets, Variational Analysis, Springer, Berlin, 1998.

Remarks
The lecture is offered irregularly. The curriculum of the next three years is available online (www.ior.kit.edu).

Course: Percolation [MATHST13]

Coordinators: G. Last
Part of the modules: Percolation (p. 97)[MATHMWST13]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Potential Theory [MATHAN20]

Coordinators: T. Arens, F. Hettlich, A. Kirsch, W. Reichel
Part of the modules: Potential Theory (p. 49)[MATHMWAN20]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Computing Lab Information Systems [PraBI]

Coordinators: A. Oberweis, R. Studer
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
Students are able to

- implement a prototype at the computer based on the given topic,
- write the thesis to present the results and the development process,
- give presentations in a scientific context in front of an auditorium to present the results.

Content
The lab intensifies and extends specific topis which are discussed within corresponding lectures. Knowledge of these lecture topics is an advantage but not a precondition.

Media
Slides, Access to internet resources

Basic literature
Literature will be given individually.

Remarks
The title of this course is a generic one. Specific titles and the topics of offered seminars will be announced before the start of a semester in the internet at http://www.aifb.uni-karlsruhe.de/Lehre

Course: Advanced Lab in Efficient Algorithms [25700p]

Coordinators: H. Schmeck
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

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

Learning Control / Examinations
The assessment consists of (according Section 4(2), 3 of the examination regulation):

- practical work
- oral presentation of the results
- written report
- discussion and collaboration

Conditions
None.

Learning Outcomes
See German version.

Content
Topics include the new research issues of the research group "applied Informatics". The new topics are in the area Organic Computing, Nature-inspired optimization and service oriented architectures.
The methods presented in the lectures are practiced during this laboratory in teamwork including implementation tasks. The results should be presented by an oral presentation and a written report.
The topics of the laboratory are introduced around the end of the former semester on the board A12 of the institute AIFB (building 11.40) and in Internet http://www.aifb.kit.edu/web/SeminarePraktika

Basic literature
Elective literature:
Will be announced at the beginning of the computer lab.

Remarks
There is a limited number of participants. Therefore students have to register for the lab.

Course: Exercises in Knowlegde Management [25740p]

Coordinators: R. Studer
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

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

Learning Control / Examinations
Assessment is based on equal parts on (acc. to §4(2), 3 SPO)

- Essay
- Presentation
- Implementation

Conditions
Attending the lecture “Wissensmanagement” [25860] is required.

Learning Outcomes
Students

- are able to independently work out a project in the domain of knowledge management

Content
This “Praktikum” covers one of the following topics (the topics rotate annually):

- Ontologie-based Knowledge Management
- Semantic Web and Linked Data Applications
- Social Software and Collaboration Tools
- Data and Web Mining
- Personal Knowledge Management
- Case-based Reasoning

Basic literature
Elective literature:
Nonaka, H. Takeuchi. The Knowledge Creating Company. Oxford University Press 1995.
G. Probst et al. Wissen managen - Wie Unternehmen ihre wertvollste Ressource optimal nutzen. Gabler Verlag 1999.
S. Staab, R. Studer. Handbook on Ontologies. Springer Verlag 2004.
R. Baeza-Yates, B. Ribeiro-Neto. Modern Information Retrieval. ACM Press 1999.

Course: Practical seminar: Health Care Management (with Case Studies) [2550498]

Coordinators: S. Nickel
Part of the modules: Operations Research in Supply Chain Management and Health Care Management (p. 130)[MATHMWOR8]

ECTS Credits	Hours per week	Term	Instruction language
7	2/1/2	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists in a case study, the writing of a corresponding paper, and an oral exam (according to §4(2), 2 of the examination regulation).

Conditions
None.

Recommendations
Basic knowledge as conveyed in the module *Introduction to Operations Research* [WI1OR] is assumed.

Learning Outcomes
The student

- is familiar with real problems arising in a hospital
- develops solution approaches for these problems by using well-known methods of Operations Research,
- is able to analyze processes and structures, to collect relevant data as well as to develop and solve models for hospital-specific problems.

Content
Processes in a hospital are often grown historically ("We have always done it this way"), so that there has not been the need to analyze processes until reforms of the health system have put increasing pressure on hospitals. Consequently, nowadays hospitals look for possibilities to improve their processes. The students are confronted with case studies and are asked to develop a solution. Therefore they have to collect and analyze relevant data , processes and structures. When developing the solution the students have to bear in mind that besides the economic efficiency also the quality of care and patient satisfaction (e.g. measured in waiting time) may not be neglected in the health care sector.

Basic literature
Elective literature:

- Fleßa: Grundzüge der Krankenhausbetriebslehre, Oldenbourg, 2007
- Fleßa: Grundzüge der Krankenhaussteuerung, Oldenbourg, 2008
- Hall: Patient flow: reducing delay in healthcare delivery, Springer, 2006

Remarks
The lecture is offered every term.
The planned lectures and courses for the next three years are announced online.

Course: Predictive Mechanism and Market Design [2520402/ 2520403]

Coordinators: P. Reiss
Part of the modules: Experimental Economics (p. 123)[MATHMW4VWL17]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	en

Learning Control / Examinations
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).
The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Recommendations
Basic knowledge of mathematics, statistics, and game theory is assumed.

Learning Outcomes
Students

- are provided with theoretical predictions in a variety of applications of mechanism and market design;
- learn about the robustness and usefulness of theoretical predictions in mechanism and market design;
- shall be able to design mechanisms and market for real-life problems.

Content
Frequently economic agents - individuals, firms, the government - need to define allocation mechanisms and can design the rules of market interactions. Examples include the provision of public goods (e.g., the reduction of CO2 emissions), the solution of matching problems (e.g., the assignment in kidney exchange), resource allocation (e.g., radio spectrum usage rights), and procurement (e.g., choice of supplier and contractual terms). Theoretical predictions are derived and confronted with data from the laboratory and the field. The course focusses on the interplay of theory with evidence to learn about the accuracy and the robustness of the theoretical predictions.

Media
Slides, problem sets.

Basic literature
A selection of published papers is compulsory reading for the course. The course syllabus provides references and is announced at the beginning of the course.

Remarks
See German version.

Course: Principles of Insurance Management [2550055]

Coordinators: U. Werner
Part of the modules: Insurance Management I (p. 112)[MATHMWBWLFBV6]

ECTS Credits	Hours per week	Term	Instruction language
4,5	3/0	Summer term	de

Learning Control / Examinations
The assessment consists of oral presentations (incl. papers) within the lecture (according to Section 4 (2), 3 of the examination regulation) and a final oral exam (according to Section 4 (2), 2 of the examination regulation).
The overall grade consists of the assessment of the oral presentations incl. papers (50 percent) and the assessment of the oral exam (50 percent).

Conditions
None.

Learning Outcomes
See German version.

Content
See German version.

Basic literature

- D. Farny. *Versicherungsbetriebslehre.* Karlsruhe 2011.
- P. Koch. *Versicherungswirtschaft - ein einführender Überblick.* 2005.
- M. Rosenbaum, F. Wagner. Versicherungsbetriebslehre. Grundlegende Qualifikationen. Karlsruhe 2002.
- U. Werner. Einführung in die Versicherungsbetriebslehre. Skript zur Vorlesung.

Elective literature:
Will be announced during the lecture.

Course: Private and Social Insurance [2530050]

Coordinators: W. Heilmann, K. Besserer
Part of the modules: Insurance Management I (p. 112)[MATHMWBWLFBV6]

ECTS Credits	Hours per week	Term	Instruction language
2,5	2/0	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam (according to Section 4 (2), 1 of the examination regulation) .
The exam takes place every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Learning Outcomes
Getting to know basic terms and functioning of private and social insurance.

Content
Basic terms of insurance, i.e. characteristics, judicial and political background and functioning of private and social insurance as well as their economic and societal and political meaning.

Basic literature
Elective literature:

- F. Büchner, G. Winter. Grundriss der Individualversicherung. 1995.
- P. Koch. Versicherungswirtschaft. 2005.
- Jahrbücher des GDV. Die deutsche Versicherungswirtschaft: http://www.gdv.de/2011/11/jahrbuch-der-deutschen-versicherungswirtschaft-2011/

Remarks
Block course. For organizational reasons, please register with the secretariat of the chair: thomas.mueller3@kit.edu

Course: Problem solving, communication and leadership [2577910]

Coordinators: H. Lindstädt
Part of the modules: Strategic Corporate Management and Organization (p. 114)[MATHMWUO1]

ECTS Credits	Hours per week	Term	Instruction language
2	1/0	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (30 minutes) (following §4(2), 1 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Recommendations
None.

Learning Outcomes
After passing this course students are able to

- structure problem solving processes.
- apply the principles of focused communication based on charts and presentations.
- understand leadership in the context of situation and personality.

Content
The course deals with various aspects of problem solving and communication processes and is divided into two parts. The first part of the course addresses the fundamental steps in the problem-solving process; namely, problem identification, problem structuring, problem analysis and communication of solution. Ideas for structuring problem solving processes will be discussed and the perquisites for and principles of structured communication based on charts and presentations will be explained. The second part of the course addresses important concepts in leadership, including the context-specificity of influence, the choice of leader and the characteristics of employees. The course content reflects current issues in management and communication practice and is oriented toward the practical application of theoretical insights to these issues. In this respect, the course aims to develop interdisciplinary skills.

Media
Slides.

Basic literature
The relevant excerpts and additional sources are made known during the course.

Course: Product and Innovation Marketing [2571154]

Coordinators: M. Klarmann
Part of the modules: Marketing Management (p. 115)[MATHMWBWLMAR5]

ECTS Credits	Hours per week	Term	Instruction language
3	2/0	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

Conditions
None.

Learning Outcomes
See German version.

Content
This course addresses topics around the management of new as well as existing products. After the foundations of product management, especially the product choice behavior of customers, students get to know in detail different steps of the innovation process. Another section regards the management of the existing product portfolio.

Remarks
For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).

Course: Project centered Software-Lab [MATHNM40]

Coordinators: G. Thäter
Part of the modules: Project centered Software-Lab (p. 84)[MATHNM40]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Public Management [2561127]

Coordinators: B. Wigger, Assistenten
Part of the modules: Collective Decision Making (p. 122)[MATHMW4VWL16]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2	Winter term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following Art. 4, para. 2, clause 1 of the examination regulation. The grade for this course equals the grade of the written exam.

Conditions
Basic knowledge of Public Finance is required.

Learning Outcomes
See German version.

Content
The lecture „Public Management“ deals with the economic theory of public sector administration. It is divided into four parts. The first section gives an overview of the legal framework of governmental administration in the Federal Republic of Germany and introduces the classical theory of administration as developed by Weber. Part two studies concepts of public decision-making, which have a significant impact on the operation of public sector administrations and where one focus is on consistency problems of collective decision-making. The third chapter deals with efficiency problems arising in conventionally organized public administrations and companies. X-inefficiency, information and control problems, the isolated consideration of income-spending-relations as well as rent-seeking problems will be considered. In section four the concept of New Public Management, which is a new approach to public sector administration that is mainly based in contract theory, is introduced. Its foundations in institutional economics are developed, with a focus on the specific incentive structures in self-administered administrations. Finally, the achievements of New Public Management approaches are discussed.

Basic literature
Elective literature:

- Damkowski, W. and C. Precht (1995): Public Management; Kohlhammer
- Richter, R. and E.G. Furubotn (2003): Neue Institutionenökonomik; 3rd edition; Mohr
- Schedler, K. and I. Proeller (2003): New Public Management; 2nd edition; UTB
- Mueller, D.C. (2009): Public Choice III; Cambridge University Press
- Wigger, B.U. (2006): Grundzüge der Finanzwissenschaft; 2nd edition; Springer

Course: Quality Control I [2550674]

Coordinators: K. Waldmann
Part of the modules: Stochastic Modelling and Optimization (p. 133)[MATHMWOR10]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1/2	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following Section 4(2), 1 of the examination regulation. Credit from the voluntary computer lab is accounted for in the overall grade raising the exam grade by a 2/3 step of a full grade (according to Section 4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
The participants will be enabled to apply modern methods of statistic quality management efficiently in the frame of total quality management. The discussion of practice-oriented case studies provides an overview of problem settings arising in each part of the production process and motivates the introduced statistic methods. The course provides profound knowledge in the areas of statistical process control utilizing modern control charts, acceptance sampling using multilayered sampling plans and the Design and Analysis of Experiments. The facultative computer exercise course comprises a practice-oriented case study in which the participants implements certain methods of quality management in order to analyze their performance.

Content
Introduction to TQM, Statistical Process Control (control charts), Acceptance Sampling (sampling plans), Design and Analysis of Experiments

Media
Blackboard, slides, flash-animations, java tools, simulation software.

Basic literature

- Lecture Notes
- Montgomery, D.C.: Introduction to Statistical Quality Control (5th ed), Wiley

Remarks
The lecture is offered irregularly. The curriculum of the next two years is available online.

Course: Quality Control II [25659]

Coordinators: K. Waldmann
Part of the modules: Stochastic Modelling and Optimization (p. 133)[MATHMWOR10]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1/2	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following Section 4(2), 1 of the examination regulation. Credit from the voluntary computer lab is accounted for in the overall grade raising the exam grade by a 2/3 step (according to Section 4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
The participants will be enabled to apply modern methods of statistic quality management efficiently in the frame of total quality management. The discussion of practice-oriented case studies provides an overview of problem settings arising in each part of the production process and motivates the introduced statistic methods. The course focuses on the methodological background of the reliability of complex systems, the estimation of lifetime distributions and maintenance. The facultative computer exercise course comprises a practice-oriented case study in which the participants implement certain methods of quality management in order to analyze their performance.

Content
Reliability Theory (structure function, reliability of complex systems, modeling and estimating lifetime distributions, systems with repair), Maintenance.

Media
Blackboard, slides, flash-animations, java tools, simulation software.

Basic literature

- Lecture Notes
- Ross, S.M.: Introduction to Probability Models (5 ed). Academic Press, 1993.
- Kohlas, J.: Zuverlässigkeit und Verfügbarkeit. B.B. Teubner, Stuttgart 1987.
- Bironlini, A.: Qualität und Zuverlässigkeit technischer Systeme, Springer, Berlin, 1991.

Remarks
The lecture is offered irregularly. The curriculum of the next two years is available online.

Course: Spatial Stochastics [MATHST14]

Coordinators: D. Hug, G. Last
Part of the modules: Spatial Stochastics (p. 98)[MATHMWST14]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Boundary and eigenvalue problems [RUEP]

Coordinators: D. Hundertmark, T. Lamm, M. Plum, W. Reichel, J. Rottmann-Matthes, R. Schnaubelt, L. Weis
Part of the modules: Boundary and eigenvalue problems (p. 42)[MATHMWAN09]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Summer term	

Learning Control / Examinations
exam:
written or oral exam
Marking:
grade of exam

Conditions
None.

Learning Outcomes

Content

Course: Risk Communication [2530395]

Coordinators: U. Werner
Part of the modules: Insurance Management I (p. 112)[MATHMWBWLFBV6]

ECTS Credits	Hours per week	Term	Instruction language
4,5	3/0	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists of oral presentations (incl. papers) within the lecture (according to Section 4 (2), 3 of the examination regulation) and a final oral exam (according to Section 4 (2), 2 of the examination regulation).
The overall grade consists of the assessment of the oral presentations incl. papers (50 percent) and the assessment of the oral exam (50 percent).

Conditions
None.

Learning Outcomes
See German version.

Content
See German version.

Basic literature
Elective literature:
R. Löfstedt, L. Frewer (Hrsg.). The Earthscan Reader in Risk & Modern Society. London 1998.
B.-M. Drottz-Sjöberg. Current Trends in Risk Communication - Theory and Practice. Hrsg. v. Directorate for Civil Defence and Emergency Planning. Norway 2003.
Munich Re. Risikokommunikation. Was passiert, wenn was passiert? www.munichre.com
O.-P. Obermeier. Die Kunst der Risikokommunikation - Über Risiko, Kommunikation und Themenmanagement. München 1999.
Fallstudien unter www.krisennavigator.de

Course: Semantic Web Technologies [2511310]

Coordinators: R. Studer, A. Harth
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Summer term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following §4, Abs. 2, 1 of the examination regulation or of 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.

Conditions
Lectures on Informatics of the Bachelor on Information Management (Semester 1-4) or equivalent are required.

Recommendations
None.

Learning Outcomes
The student

- understands the motivation and foundational ideas behind Semantic Web and Linked Data technologies, and is able to analyse and realise systems
- demonstrates basic competency in the areas of data and system integration on the web
- masters advanced knowledge representation scenarios involving ontologies

Content
"Semantic Web" denotes an extension of the World Wide Web with meta data and applications to make the meaning (semantics) of data on the web usable in intelligent systems, e.g. in e-commerce and internet portals.
Central concepts are the representation and processing of knowledge in form of ontologies and the access via Linked Data. This lecture provides the foundations of knowledge representation and processing for the corresponding technologies and presents example applications.
The following topics are covered:

- Resource Description Framework (RDF) and RDF Schema (RDFS)
- Web Architecture and Linked Data
- Web Ontology Language (OWL)
- Rule languages
- Applications

Media
Lecture notes.

Basic literature
See German version.

Remarks
The lecture supersedes the existing SWT-1 and SWT-2 lectures beginning from SS 2014. The exams SWT-1 and SWT-2 will be offered latest until winter term 2014/15.

Course: Seminar in Enterprise Information Systems [SemAIFB1]

Coordinators: R. Studer, A. Oberweis, T. Wolf, R. Kneuper
Part of the modules: Seminar (p. 137)[MATHMWSEM03]

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

Learning Control / Examinations

Conditions
See corresponding module information.

Learning Outcomes
Students

- do literature search based on a given topic, identify relevant literature and evaluate this literature,
- give presentations in a scientific context in front of an auditorium to present the results of the research,
- present results of the research in a seminar thesis as a scientific publication using format requirements such as those recommended by well-known publishers.

Content
The seminar intensifies and extends specific topis which are discussed within corresponding lectures. Knowledge of these lecture topics is an advantage but not a precondition.
Specific titles and the topics of offered seminars will be announced before the start of a semester in the internet at http://www.aifb.uni-karlsruhe.de/Lehre

Basic literature
Literature will be given individually in the specific seminar.

Course: Seminar Efficient Algorithms [SemAIFB2]

Coordinators: H. Schmeck
Part of the modules: Seminar (p. 137)[MATHMWSEM03]

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

Learning Control / Examinations
The assessment consists of a talk (presentation of 45-60 minutes) about the research topic of the seminar together with discussion, a written summary about the major issues of the topic (approx. 15 pages) and attending the discussions of the seminar (according Section 4(2), 3 of the examination regulation).
The grade of this course is achieved by the weighted sum of the grades (talk 50%, written summary 30% and discussion 20%). This seminar is for bachelor as well as master students. The difference between them is calculated according to different evaluation mechanisms for the written summary work and the talk.

Conditions
See corresponding module information.

Learning Outcomes
The students should learn to work on research papers by searching for new topics in computer science and by presenting the major issues of the papers.
The master students should deepen their ability to develop independent insight into new scientific topics and to communicate them through oral presentation and written summary to others.
The students will learn to deal with critical discussions on scientific presentations and written summaries through active participation in the seminar.

Content
Topics include the new research issues of the research group “applied Informatics”. The new topics are in the area Organic Computing, Nature-inspired optimization and service oriented architectures.
The topics of the seminars are introduced around the end of the former semester on the board A12 of the institute AIFB (building 11.40) and in Internet http://www.aifb.kit.edu/web/SeminarePraktika

Basic literature
Will be announced at the beginning of the semester.

Remarks
There is a limited number of participants. The students have to register for the seminar.

Course: Seminar in Finance [2530280]

Coordinators: M. Uhrig-Homburg, M. Ruckes
Part of the modules: Seminar (p. 136)[MATHMWSEM02]

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

Learning Control / Examinations

Conditions
None.

Recommendations
Knowledge of the content of the modules *Essentials of Finance* [WW3BWLFBV1] or *F1 (Finance)* [MATHMWBWLFBV1] is assumed.

Learning Outcomes
The student gets in touch with scientific work. Through profound working on a specific scientific topic the student is meant to learn the foundations of scientific research and reasoning in particular in finance.
Through the presentations in this seminar the student becomes familiar with the fundamental techniques for presentations and foundations of scientific reasoning. In addition, the student earns rhetorical skills.

Content
Within this seminar different topics of current concern are treated. These topics have their foundations in the contents of certain lectures.
The topics of the seminar are published on the website of the involved finance chairs at the end of the foregoing semester.

Basic literature
Will be announced at the end of the foregoing semester.

Course: Seminar Financial Economics and Risk Management [2530353]

Coordinators: M. Ulrich
Part of the modules: Seminar (p. 136)[MATHMWSEM02]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Winter / Summer Term	

Learning Control / Examinations
See German version.

Conditions
None.

Learning Outcomes

Content

Course: Seminar in Economic Policy [SemIWW3]

Coordinators: I. Ott
Part of the modules: Seminar (p. 136)[MATHMWSEM02]

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

Learning Control / Examinations
The assessment is carried out through a term paper within the range of 12 to 15 pages, a presentation of the results of the work in a seminar meeting, and active participation in the discussions of the seminar meeting (§ 4 (2), 3 SPO).

The final grade is composed of the weighted graded examinations. (Essay 50%, 40% oral presentation, active participation 10%).

The seminar is intended for students both of bachelor and master degree program. They are differentiated by different assessment criteria for term paper and presentation grading.

Conditions
At least one of the lectures “Theory of Endogenous Growth” or “Innovation Theory and Policy” should be attended in advance, if possible.

Learning Outcomes
Students are able to

- work on an economic policy question based the scientific literature by employing fundamental methods from economics
- conduct a thorough literature research and (if applicable) illustrate their results with e.g. Mathematica
- present their results in a term paper that satisfies the requirements of a scientific publication
- give a presentation of their results together with another participant of the seminar
- discuss the term papers and presentations of the other participants

Content
The current topic of the seminar including the subjects treated will be announced before the semester begins at http://wipo.iww.kit.edu.
Previous Topics:

- Economic Aspects of General Purpose Technologies (SS 2010)
- Questions of Modern Economic Growth Theories (WS 2010/2011)
- Beans or fully automated machines? Determinants of Developement and Growth in a globalized World (SS 2011)
- Technology Assessment and strategic Patent Analyses (WS 2011/2012)
- Innovation Potentials and Spatial Dimension in Cultural and Creative Industries (WS 2011/2012)
- Quantitative Methods in Economics with Mathematica (SS 2012)

Course: Seminar Risk and Insurance Management [SemFBV1]

Coordinators: U. Werner
Part of the modules: Seminar (p. 136)[MATHMWSEM02]

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

Learning Control / Examinations

Conditions

See corresponding module information.
The seminar is held within the courses of *Risk and Insurance Management and Insurance Management* ([WW3BWLFBV3], [WW3BWLFBV4] and [WW4BWLFBV6/7], respectively.
A course taken as a seminar cannot be chosen as a part of a course module (and vice versa).

Recommendations

The seminar fits well with the bachelor modules *Risk and Insurance Management* [WW3BWLFBV3] as well as with the master modules *Insurance Management I* [MATHMWBWLFBV6] and *Insurance Management* II [WW4BWLFBV7]. These modules, though, are not required to be taken.

Learning Outcomes

See German version.

Content

The seminar is offered within the following courses:

- Principles of Insurance Management
- Insurance Marketing
- Insurance Production
- Risk Communication
- Insurance Risk Management
- Enterprise Risk Management
- Modeling, Measuring and Management of Extreme Risks
- Current Issues in the Insurance Industry

For their contents refer to the information given for these courses.

Basic literature

Will be announced at the beginning of the lecture period.

Remarks

Some of the courses mentioned above are offered on demand. For further information, see:http://insurance.fbv.kit.edu.
To attend the course please register with the secretary of the chair: thomas.mueller3@kit.edu

Course: Seminar Service Science, Management & Engineering [2595470]

Coordinators: C. Weinhardt, R. Studer, S. Nickel, H. Fromm, W. Fichtner, G. Satzger
Part of the modules: Seminar (p. 137)[MATHMWSEM03]

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

Learning Control / Examinations
The assessment of this course is according to §4(2), 3 SPO in form of an examination of the written seminar thesis (15-20 pages), a presentation and active participation in class.
The final mark is based on the examination of the written seminar thesis but can be upgraded or downgraded according to the quality of the presentation.

Conditions
See corresponding module information.

Recommendations
Lecture *eServices* [2595466] is recommended.

Learning Outcomes
The student

- illustrates and evaluates classic and current research questions in service science, management and engineering,
- applies models and techniques in service science, also with regard to their applicability in practical cases,
- successfully gets in touch with scientific working by an in-depth working on a special scientific topic which makes the student familiar with scientific literature research and argumentation methods,
- acquires good rhetorical and presentation skills.

As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the seminar topic.

Content
Each Semester, the seminar will cover topics from a different selected subfield of Service Science, Management & Engineering. Topics include service innovation, service economics, service computing, transformation and coordination of service value networks as well as collaboration for knowledge intensive services.
See the KSRI website for more information about this seminar: www.ksri.kit.edu

Basic literature
The student will receive the necessary literature for his research topic.

Course: Seminar Stochastic Models [SemWIOR1]

Coordinators: K. Waldmann
Part of the modules: Seminar (p. 137)[MATHMWSEM03]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Winter / Summer Term	

Learning Control / Examinations
The assessment of this course is in form of an examination of the written seminar thesis and a presentation. The final mark is the result of both the paper and its presentation.

Conditions
None.

Learning Outcomes
The participants will posses profound knowledge of modelling, evaluation and optimization of stochastic systems .They are familiar with basic principles of scientific argumentation and can cope with modern presentation techniques.

Content
The actual topic as well as the contemporary issues are available online.

Media
Power Point and related presentation techniques.

Basic literature
Will be presented with the actual topic.

Course: Seminar Knowledge Management [SemAIFB4]

Coordinators: R. Studer
Part of the modules: Seminar (p. 137)[MATHMWSEM03]

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

Learning Control / Examinations

Conditions
See module description.

Learning Outcomes
The students will learn to perform literature searches on current topics in computer science and holistic knowledge management as well as preparing and presenting the contents of scientific publications.

During the work on the seminar topics the master students will deepen their skills to autonomously comprehend current scientific knowledge and to convey it to others through oral presentations and written summaries.

Through active participation in the seminar, students acquire skills in critical appraisal of research topics and in oral and written presentation of independently developed research content.

Content
Each year, the seminar will cover topics from a different selected subfield of knowledge management, e.g.:

- Ontology-based knowledge management,
- Information Retrieval and Text Mining,
- Data Mining,
- Personal Knowledge Management,
- Case Based Reasoning (CBR),
- Collaboration and Scoial Computing,
- Business-process Oriented Knowledge Management.

Media
Slides.

Basic literature

- I. Nonaka, H. Takeuchi: The Knowledge Creating Company. Oxford University Press 1995
- G. Probst et al.: Wissen managen - Wie Unternehmen ihre wertvollste Ressource optimal nutzen. Gabler Verlag, Frankfurt am Main/ Wiesbaden, 1999
- Pascal Hitzler, Markus Krötzsch, Sebastian Rudolf, York Sure: Semantic Web - Grundlagen, Springer, 2008 (ISBN 978-3-540-33993-9)
- S. Staab, R. Studer: Handbook on Ontologies, ISBN 3-540-40834-7, Springer Verlag, 2004
- Modern Information Retrieval, Ricardo Baeza-Yates & Berthier Ribeiro-Neto. New York, NY: ACM Press; 1999; 513 pp. (ISBN: 0-201-39829-X.)

Remarks
The number of students is limited. Students have to observe the designated registration process.

Course: Seminar in Discrete Optimization [2550491]

Coordinators: S. Nickel
Part of the modules: Seminar (p. 137)[MATHMWSEM03]

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

Learning Control / Examinations
The assessment consists of a written seminar thesis of 20-25 pages and a presentation of 35-40 minutes (according to §4(2), 3 of the examination regulation).
The final mark for the seminar consists of the seminar thesis, the seminar presentation, the handout, and if applicable further material such as programming code.
The seminar can be attended both by Bachelor and Master students. A differentiation will be achieved by different valuation standards for the seminar thesis and presentation.

Conditions
Attendance is compulsory.
If possible, at least one module of the institute should be taken before attending the seminar.

Learning Outcomes
The student

- illustrates and evaluates classic and current research questions in discrete optimization,
- applies optimization models and algorithms in discrete optimization, also with regard to their applicability in practical cases (especially in Supply Chain and Health Care Management),
- successfully gets in touch with scientific working by an in-depth working on a special scientific topic which makes the student familiar with scientific literature research and argumentation methods,
- acquires good rhetorical and presentation skills.

As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the seminar topic.

Content
The topics of the seminar will be announced at the beginning of the term in a preliminaty meeting. Dates will be announced on the internet.

Basic literature
Literature and relevant sources will be announced at the beginning of the seminar.

Remarks
The seminar is offered in each term.

Course: Seminar in Experimental Economics [SemWIOR3]

Coordinators: N. N.
Part of the modules: Seminar (p. 136)[MATHMWSEM02]

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

Learning Control / Examinations

Conditions
See corresponding module information.
A course in the field of Game Theory should be attended beforehand.

Learning Outcomes
The seminar wants to deepen the methods of scientific work. Students shall learn to discuss critical the latest research results in Experimental Economics.
Students learn the technical basics of presentation and to argument scientifically. Also rethoric skills shall be amplified.

Content
The seminar's topic will be announced before the beginning of each semester on the internet (http://www.wior.uni-karlsruhe.de/LS_Berninghaus/Studium/).

Media
Slides.

Basic literature
Will be announced at the end of the recess period.

Course: Seminar in Continous Optimization [2550131]

Coordinators: O. Stein
Part of the modules: Seminar (p. 137)[MATHMWSEM03]

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

Learning Control / Examinations
The assessment is composed of a 15-20 page paper as well as a 40-60 minute oral presentation according to §4(2), 3 of the examination regulation.
The total grade is composed of the equally weighted grades of the written and oral assessments.
The seminar is appropriate for bachelor as well as for master students. Their differentiation results from different assessment criteria for the seminar paper and the seminar presentation.

Conditions
See corresponding module information.
Attendance is compulsory.
Preferably at least one module offered by the institute should have been chosen before attending this seminar.

Learning Outcomes
The seminar aims at describing, evaluating, and discussing recent as well as classical topics in continuous optimization. The focus is on the treatment of optimization models and algorithms, also with respect to their practical application.
The student is introduced to the style of scientific work. By focussed treatment of a scientific topic the student learns the basics of scientific investigation and reasoning.
For further development of a scientific work style, master students are particularly expected to critically question the seminar topics.
With regard to the oral presentations the students become acquainted with presentation techniques and basics of scientifc reasoning. Also rethoric abilities may be improved.

Content
The current seminar topics are announced under http://kop.ior.kit.edu at the end of the preceding semester.

Basic literature
References and relevant sources are announced at the beginning of the seminar.

Course: Seminar on Macroeconomic Theory [SemETS3]

Coordinators: M. Hillebrand
Part of the modules: Seminar (p. 136)[MATHMWSEM02]

ECTS Credits	Hours per week	Term	Instruction language
3	2		

Learning Control / Examinations

Conditions
None.

Recommendations
At least one of the courses *Theory of Business Cycles[25549]* and *Theory of Economic Growth [2520543]* should have been attended beforehand.

Learning Outcomes
See German version.

Content

Basic literature
Will be announced at the end of the recess period.

Remarks
for details see German version.

Course: Seminar: Management and Organization [2577915]

Coordinators: H. Lindstädt
Part of the modules: Seminar (p. 136)[MATHMWSEM02]

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

Learning Control / Examinations

Conditions
See corresponding module information.

Learning Outcomes
The aim of the seminar is to describe corporate and organisational management approaches, to assess them critically and clarify them using practical examples. The focus is on assessing the models with a view to their applicability and theoretical limits.

Content
The subjects are redefined each semester on the basis of current issues.

Media
Slides.

Basic literature
The relevant sources are made known during the course.

Course: Practical Seminar Knowledge Discovery [25810]

Coordinators: R. Studer
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

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

Learning Control / Examinations

Conditions
None.

Recommendations
Knowledge of algorithms in the area of knowledge discovery is assumed. Therefore it is recommended to attend the course [2511302] Knowledge Discovery beforehand.

Learning Outcomes
Students

- know fundamentals of Machine Learning, Data Mining and Knowledge Discovery
- are able to design, train and evaluate adaptive systems
- conduct Knowledge Discovery projects in regards to algorithms, representations and applications.

Content
The practical course will cover topics in the field of knowledge discovery. Each term, a different topic is covered, e.g.: text mining or learning with semantic data. Details will be announced every semester.

Media
Slides.

Course: Service Oriented Computing 2 [2511308]

Coordinators: R. Studer, S. Agarwal, B. Norton
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Summer term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following §4, Abs. 2, 1 of the examination regulation or of an oral exam (20 min) following §4, Abs. 2, 2 of the examination regulation.

Conditions
None.

Recommendations
It is recommended to attend the course *Service-oriented Computing 1* [2511500] beforehand.

Learning Outcomes
Students will extend their knowledge and proficiency in the area of modern service-oriented technologies. Thereby, they acquire the capability to understand, apply and assess concepts and methods that are of innovative and scientific nature.

Content
Building upon basic Web service technologies the lecture introduces select topics of advanced service computing and service engineering. In particular, focus will be placed on new Web-based architectures and applications leveraging Web 2.0, Cloud Computing, Semantic Web and other emerging technologies.

Basic literature
Literature will be announced in the lecture.

Course: Simulation I [2550662]

Coordinators: K. Waldmann
Part of the modules: Stochastic Methods and Simulation (p. 129)[MATHMWOR7], Applications of Operations Research (p. 126)[MATHMWOR5], Stochastic Modelling and Optimization (p. 133)[MATHMWOR10]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1/2	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following Section 4(2), 1 of the examination regulation. Credit from the voluntary computer lab is accounted for in the overall grade raising the exam grade by a 2/3 step of a full grade (according to Section 4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
The participants will be enabled to model discrete event systems that underlie stochastic influences and to analyze them using simulation. The discussion of practice-oriented case studies pursues two goals. On the one hand, the participants will be sensitized for different criteria to evaluate the performance of a stochastic discrete-event system. On the other hand, an overview of application areas of stochastic simulation is provided. In the context of the course, the basic elements of discrete-event simulation are introduced and a procedure model for the execution of simulation studies is developed. Properties of existing mathematical methods for the generation of random variables are discussed and are assigned to concrete application cases. Statistical methods for the description of simulation input data and for the interpretation of simulation results will be exemplified. The facultative computer exercise course using a simulation software comprises a practice-oriented case study that illustrates the opportunities and limitations of stochastic simulation.

Content
Generation of random numbers, Monte Carlo Integration, discrete event simulation, discrete random variables, continuous random variables, statistical analysis of simulated data.

Media
Blackboard, slides, flash-animations, java tools, simulation software.

Basic literature

- Lecture Notes
- K.-H. Waldmann/U. M. Stocker: Stochastische Modelle - Eine anwendungsorientierte Einführung, Springer (2012), 2. Auflage
- Elective literature: A. M. Law/W.D. Kelton: Simulation Modeling and Analysis (3rd ed), McGraw Hill (2000)

Remarks
The course will be offered in the summer term 2015 and the summer term 2016.

Course: Simulation II [2550665]

Coordinators: K. Waldmann
Part of the modules: Stochastic Modelling and Optimization (p. 133)[MATHMWOR10], Stochastic Methods and Simulation (p. 129)[MATHMWOR7]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1/2	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following Section 4(2), 1 of the examination regulation. Credit from the voluntary computer lab is accounted for in the overall grade raising the exam grade by a 2/3 step of a full grade (according to Section 4(2), 3 of the examination regulation).

Conditions
Foundations in the field of *Simulation I* [2550662] are desired.

Learning Outcomes
The participants will be enabled to model and analyze discrete event systems that underlie stochastic influences with efficient simulation techniques. The discussion of practice-oriented case studies illustrates the limits of standard simulation techniques for stochastic discrete event systems regarding the simulation effort to obtain statistical significant results. Variance reducing techniques will be introduced in theory as modern and efficient techniques and will be exemplified by examples from quality management, financial engineering and insurance. The main scope of the applications discussed in the course is the efficient simulation of stochastic processes. The facultative computer exercise course under utilization of the programming language Java comprises a practice-oriented case study, in which the participants implement certain variance reducing techniques in order to analyze the reduction in computer effort in comparison to standard techniques.

Content
Variance reducing techniques, simulation of sochastic processes, case studies.

Media
Blackboard, slides, flash-animations, java tools, simulation software.

Basic literature

- Lecture Notes
- K.-H. Waldmann/U. M. Stocker: Stochastische Modelle - Eine anwendungsorientierte Einführung, Springer (2012), 2. Auflage
- Elective literature: A. M. Law/W.D. Kelton: Simulation Modeling and Analysis (3rd ed), McGraw Hill (2000)

Remarks
The course will be offered in the winter term 2015/2016.

Course: Smart Energy Distribution [2199118]

Coordinators: H. Schmeck
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

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

Learning Control / Examinations
The examination results from the chosen module, otherwise:
oral/written examination depending on number of students

Conditions
The students should have an understanding of informatics, they would benefit from some previous knowledge of self-organisation an methods for optimisation, but this is not mandatory

Learning Outcomes
The students will develop an understanding of the basic problems that arise from decentralisation and an increased share of renewables in the power mix and they will know how to deal with these problems by using concepts like virtualisation and self-organisation. They will know how to design and apply adequate methods for smart energy distribution in various related problem settings and they will be capable to explain the appropriate use of these methods. The students will get to know the scope of topics in energy informatics.

Content
The course addresses the role of information and communication technologies for the distribution of energy. The increasing share of power generation from renewable sources and the decentralisation of power generation lead to an increasing need for local balancing of power supply and demand. While traditional power management was based on the assumption that power consumption is not controllable and that electric power cannot be stored effectively, future power management will depend significantly on much more flexibility in demand and in innovative ways of storing energy.
The course will present concepts for smart energy management that have been developed in projects on “e-energy” and electric mobility, like virtual power plants, local agent-based power management, concepts of load shifting, autonomic and organic approaches to power management in smart homes, utilization of mobile and stationary batteries for stabilization of the power grid.
The concepts presented in this course are essential for the new disciplin of energy informatics.

Media
slides, annotations using tablet pc technology, lecture recording using camtasia

Remarks
This course is offered to students of the MSc program EnTech but may also be taken by students of the Master programs Industrial Engineering, Economics Engineering and Mathematics in Economics.

Course: Sobolev Spaces [MATHAN37]

Coordinators: A. Kirsch
Part of the modules: Sobolev Spaces (p. 54)[MATHAN37]

ECTS Credits	Hours per week	Term	Instruction language
5	2/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Social Choice Theory [2520537]

Coordinators: C. Puppe
Part of the modules: Microeconomic Theory (p. 121)[MATHMW4VWL15], Collective Decision Making (p. 122)[MATHMW4VWL16]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	en

Learning Control / Examinations
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Recommendations
None.

Learning Outcomes
The student should acquire knowledge of formal theories of collective decision making and learn to apply them to real life situations.

Content
The course provides a comprehensive treatment of preference and judgement aggregation, including proofs of general results that have Arrow's famous impossibility theorem and Gibbard's oligarchy theorem as corollaries. The second part of the course is devoted to voting theory. Among other things, we prove the Gibbard-Satterthwaite theorem. An introduction into tournament theory concludes the course.

Basic literature
Main texts:

- Hervé Moulin: Axioms of Cooperative Decision Making, Cambridge University Press, 1988
- Christian List and Clemens Puppe: Judgement Aggregation. A survey, in: Handbook of rational & social choice, P.Anand, P.Pattanaik, C.Puppe (Eds.), Oxford University Press 2009.

Secondary texts:

- Amartya Sen: Collective Choice and Social Welfare, Holden-Day, 1970
- Wulf Gaertner: A Primer in Social Choice Theory, revised edition, Oxford University Press, 2009
- Wulf Gaertner: Domain Conditions in Social Choice Theory, Oxford University Press, 2001

Course: Software Laboratory: OR Models I [2550490]

Coordinators: S. Nickel
Part of the modules: Applications of Operations Research (p. 126)[MATHMWOR5]

ECTS Credits	Hours per week	Term	Instruction language
4,5	1/2	Winter term	de

Learning Control / Examinations
The assessment is a 120 minutes examination, including a written and a practical part (according to §4(2), 1 of the examination regulation).
The examination is held in the term of the software laboratory and the following term.

Conditions
Firm knowledge of the contents from the lecture *Introduction to Operations Research I* [2550040] of the module *Operations Research* [WI1OR].

Learning Outcomes
The student

- evaluates the possibilities of computer usage in practical applications of Operations Research,
- is capable of classifying and utilizing the general possibilities and fields of usage of modeling and implementation software for solving OR models in practice,
- models and solves problems arising in industry applications with the aid of computer-supported optimization methods.

Content
After an introduction to general concepts of modelling tools (implementation, data handling, result interpretation, ...), the software IBM ILOG CPLEX Optimization Studio and the corresponding modeling language OPL will be discussed which can be used to solve OR problems on a computer-aided basis.
Subsequently, a broad range of exercises will be discussed. The main goals of the exercises from literature and practical applications are to learn the process of modeling optimization problems as linear or mixed-integer programs, to efficiently utilize the presented tools for solving these optimization problems and to implement heuristic solution procedures for mixed-integer programs.

Remarks
Due to capacity restrictions, registration before course start is required. For further information see the webpage of the course.
The lecture is offered in every winter term. The planned lectures and courses for the next three years are announced online.

Course: Software Laboratory: OR Models II [2550497]

Coordinators: S. Nickel
Part of the modules: Operations Research in Supply Chain Management and Health Care Management (p. 130)[MATHMWOR8]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	de

Learning Control / Examinations
The assessment is a 120 minutes examination, including a written and a practical part (according to §4(2), 1 of the examination regulation).
The examination is held in the term of the software laboratory and the following term.

Conditions
Successful completion of the course *Software Laboratory: OR-Models I* [2550490].
Basic knowledge as conveyed in the module *Introduction to Operations Research* [WI1OR] is assumed.

Learning Outcomes
The student

- is an expert in using computer systems to model and solve industry-related optimization problems,
- conducts an advanced approach to modeling and implementation software for OR models and is able to use them in practice,
- knows and explains the practical application possibilities of OR software in complex combinatorial and nonlinear optimization problems.

Content
The task of solving combinatorial and nonlinear optimization problems imposes much higher requirements on suggested solution approaches as in linear programming.
During the course of this software laboratory, students get to know important methods from combinatorial optimization, e.g. Branch & Cut- or Column Generation methods and are enabled to solve problems with the software system IBM ILOG CPLEX Optimization Studio and the corresponding modeling language OPL. In addition, issues of nonlinear optimization, e.g. quadratic optimization, are addressed. As an important part of the software laboratory, students get the possibility to model combinatorial and nonlinear problems and implement solution approaches in the software system.
The software laboratory also introduces some of the most frequently used modelling and programming languages that are used in practice to solve optimization problems.

Remarks
Due to capacity restrictions, registration before course start is required. For further information see the webpage of the course.
The lecture is held irregularly. The planned lectures and courses for the next three years are announced online.

Course: Software Quality Management [2511208]

Coordinators: A. Oberweis
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Summer term	de

Learning Control / Examinations
The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation in the first week after lecture period.

Conditions
Programming knowledge in Java and basic knowledge of computer science are expected.

Learning Outcomes
Students

- explain the relevant quality models,
- apply methods to evaluate the software quality and evaluate the results,
- know the mail models of sofware certification, compare and evaluate these models,
- write scientific theses in the area of software quality management and find own solutions for given problems.

Content
This lecture imparts fundamentals of active software quality management (quality planning, quality testing, quality control, quality assurance) and illustrates them with concrete examples, as currently applied in industrial software development. Keywords of the lecture content are: software and software quality, process models, software process quality, ISO 9000-3, CMM(I), BOOTSTRAP, SPICE, software tests.

Media
Slides, access to internet resources.

Basic literature

- Helmut Balzert: Lehrbuch der Software-Technik. Spektrum-Verlag 2008
- Peter Liggesmeyer: Software-Qualität, Testen, Analysieren und Verifizieren von Software. Spektrum Akademischer Verlag 2002
- Mauro Pezzè, Michal Young: Software testen und analysieren. Oldenbourg Verlag 2009

Elective literature:
Further literature is given in lectures.

Remarks
This course was formely named “Software Technology: Quality Management”.

Course: Spatial Economics [2561260 / 2561261]

Coordinators: I. Ott
Part of the modules: Growth and Agglomeration (p. 119)[MATHMWVWL12]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	en

Learning Control / Examinations
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

Conditions
None.

Recommendations
Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012], and Economics II [2600014]. In addition, an interest in quantitative-mathematical modeling is required. The attendance of the course Introduction to economic policy [2560280] is recommended.

Learning Outcomes
The student

- analyses how spatial distribution of economic activity is determined
- uses quantitative methods within the context of economic models
- has basic knowledge of formal-analytic methods
- understands the link between economic theory and its empirical applications
- understands to what extent concentration processes result from agglomeration and dispersion forces
- is able to determine theory based policy recommendations

Content
Geography, trade and development
Geography and economic theory
Core models of economic geography and empirical evidence
Agglomeration, home market effect, and spatial wages
Applications and extensions

Media
Slides
Exercises
Internet

Basic literature
Steven Brakman, Harry Garretsen, Charles van Marrewijk (2009), The New Introduction to Geographical Economics
Further literature recommendations will be announced in the course of the lecture.

Course: Spectral Theory [SpekTheo]

Coordinators: G. Herzog, C. Schmoeger, R. Schnaubelt, L. Weis
Part of the modules: Spectral Theory (p. 43)[MATHMWAN10]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Summer term	

Learning Control / Examinations

Conditions
None.

Recommendations
It is recommended to attend the following modules previously:
Linear Algebra 1+2
Analysis 1-3
Functional Analysis or Differential Equations and Hilbert Spaces

Learning Outcomes

Content

Course: Special Topics of Enterprise Information Systems [SBI]

Coordinators: A. Oberweis
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Winter / Summer Term	de

Learning Control / Examinations
The assessment of this course is a written or (if necessary) oral examination according to §4(2) of the examination regulation.

Conditions
None.

Learning Outcomes
Students

- explain basic knowledge and concepts in a subarea of “Enterprise Information Systems”,
- apply methods and instruments in a subarea of “Enterprise Information Systems”,
- choose the appropriate methods to solve given problems and apply them,
- find and discuss arguments for solution approaches.

Content
This course is a placeholder for special courses that are offered in an irregular sequence and cover selected topics in the field of enterprise information systems. These topics include in particular the design and the management of database systems, the computer-support of business processes and strategic planning of information systems and their organization.

Basic literature
Will be announced at the beginning of the course.

Course: Special Topics of Efficient Algorithms [25700sp]

Coordinators: H. Schmeck
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists of assignments or of a bonus exam (wrt §4 (2), 3 SPO), and a written exam (60 min.) in the week after the end of the lecturing periodwrt (§4 (2), 1 SPO). The exam will be offered in every semester and can be repeated on regular examination dates.
If the mark obtained in the written exam is in between 1.3 and 4.0, a successful completion of the assignments or the bonus exam will improve the mark by one level (i.e. by 0.3 or 0.4).

Conditions
None.

Learning Outcomes
The student will learn how to use methods and concepts of efficient algorithms and how to demonstrate adequate innovative capabilities with respect to the used methods.
This course emphasizes the teaching of advanced concepts in relation to their applicability in the real world. Based on a fundamental understanding of the covered concepts and methods, students should know how to select appropriate concepts and methods for problem settings in their professional life, and, if necessary, to extend and apply them in an adequate form. The students should be enabled to find adequate arguments for justifying their chosen problem solutions.

Content
This course emphasizes the new topics in the area of algorithms, data structures, and computer infrastructures. The exact topics can vary according to the audiences and the time it is held.

Basic literature
Elective literature:
Will be announced in the lecture.

Remarks
This course can be particularly used for recognising the external courses with the topics in the area of algorithms, data-structures and computer infrastructures but are not associated in other courses in this subject area.

Course: Special Topics of Software- and Systemsengineering [SSEsp]

Coordinators: A. Oberweis
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Winter / Summer Term	

Learning Control / Examinations
The assessment consists of an 1h written exam in the first week after lecture period.

Conditions
None.

Learning Outcomes
Students

- explain basic knowledge and concepts in a subarea of “Software and Systems Engineering”,
- apply methods and instruments in a subarea of “Software and Systems Engineering”,
- choose the appropriate methods to solve given problems and apply them,
- find and discuss arguments for solution approaches.

Content
This course is a placeholder for special courses that are offered in an irregular sequence and cover selected topics in the field of software and systems engineering.

Media
Slides, access to internet resources

Basic literature
Elective literature:
Will be announced at the beginning of the course.

Remarks
This course can be used in particular for the acceptance of external courses whose content is in the broader area of software and systems engineering, but cannot assigned to another course of this topic.

Course: Special Topics of Knowledge Management [25860sem]

Coordinators: R. Studer
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Winter / Summer Term	de

Learning Control / Examinations
Assesment is provided by a written exam of 60 minutes or an oral exam during the first few weeks after the lecturing period (acc. to §4(2), 1 or 2 SPO). The exam is offered each semester and may be repeated at the regular examination day.

Conditions
The lecture *Angewandte Informatik I - Modellierung* [2511030] is a prerequisite.

Learning Outcomes
The lecture serves as placeholder for course achievements abroad.
The students acquire the skills, methods and tools in one specialized topic of "knowledge management" to demonstrate their mastery and innovativeness.
The lecture aims at providing principles and methods in the context of the practical application of KM. On the basis of a fundamental understanding of concepts, methods, and tools, students will be able to work on advanced problems. The students will be able to find and argue for solutions of KM problems.

Content
The lecture serves as placeholder for course achievements abroad.
The lecture deals with special topics in the area of knowledge management (incl. Knowledge Discovery and Semantic Web). The lecture deepens one of the following topics:

- Dynamic and Interoperable Systems in Knowledge Management
- Personal and Process-oriented Knowledge Management
- Formal Concept Analysis
- Semantic Search and Text Mining
- Combination of Social Software and Semantic Web

Basic literature
Elective literature:
Depends on the actual content.

Course: Special Topics in Optimization I [2550128]

Coordinators: O. Stein
Part of the modules: Mathematical Programming (p. 132)[MATHMWOR9]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter / Summer Term	de

Learning Control / Examinations
The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation.

The examination is held in the semester of the lecture and in the following semester.

Prerequisite for admission to the written examination is attaining at least 30% of the exercise points. Therefore the online-registration for the written examination is subject to fulfilling the prerequisite.

The examination can also be combined with the examination of *Special Topics in Optimization II* [25126]. In this case, the duration of the written examination takes 120 minutes.

Conditions
None.

Recommendations
It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

Learning Outcomes
The student

- knows and understands the fundamentals of a special topic in continuous optimization,
- is able to choose, design and apply modern techniques of this special topic in continuous optimization in practice.

Content

Remarks
The lecture is offered irregularly. The curriculum of the next three years is available online (www.ior.kit.edu).

Course: Special Topics in Optimization II [2550126]

Coordinators: O. Stein
Part of the modules: Mathematical Programming (p. 132)[MATHMWOR9]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter / Summer Term	de

Learning Control / Examinations
The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation.

The examination is held in the semester of the lecture and in the following semester.

Prerequisite for admission to the written examination is attaining at least 30% of the exercise points. Therefore the online-registration for the written examination is subject to fulfilling the prerequisite.

The examination can also be combined with the examination of *Special Topics in Optimization I* [25128]. In this case, the duration of the written examination takes 120 minutes.

Conditions
None.

Recommendations
It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

Learning Outcomes
The student

- knows and understands the fundamentals of a special topic in continuous optimization,
- is able to choose, design and apply modern techniques of this special topic in continuous optimization in practice.

Content

Remarks
The lecture is offered irregularly. The curriculum of the next three years is available online (www.ior.kit.edu).

Course: Special functions and applications in potential theory [MATHAN33]

Coordinators: A. Kirsch
Part of the modules: Special functions and applications in potential theory (p. 53)[MATHAN33]

ECTS Credits	Hours per week	Term	Instruction language
5	2/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Facility Location and Strategic Supply Chain Management [2550486]

Coordinators: S. Nickel
Part of the modules: Applications of Operations Research (p. 126)[MATHMWOR5], Operations Research in Supply Chain Management and Health Care Management (p. 130)[MATHMWOR8], Methodical Foundations of OR (p. 128)[MATHMWOR6]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam (120 min) according to Section 4 (2), 1 of the examination regulation.
The exam takes place in every semester.
Prerequisite for admission to examination is the succesful completion of the online assessments.

Conditions
Prerequisite for admission to examination is the succesful completion of the online assessments.

Learning Outcomes
The student

- knows and describes basic quantitative methods in location planning in the context of strategic Supply Chain Planning,
- applies several criteria for the evaluation of the locations of facilities in the context of classical location planning models (planar models, network models and discrete models) and advanced location planning models designed for Supply Chain Management (single-period and multi-period models),
- implements the considered models in practical problems.

Content
Since the classical work “Theory of the Location of Industries” of Weber from 1909, the determination of an optimal location of a new facility with respect to existing customers is strongly connected to strategical logistics planning. Strategic decisions concerning the location of facilities as production plants, distribution centers or warehouses are of high importance for the rentability of supply chains. Thoroughly carried out, location planning allows an efficient flow of materials and leads to lower costs and increased customer service.
Subject of the course is an introduction to the most important terms and definitions in location planning as well as the presentation of basic quantitative location planning models. Furthermore, specialized location planning models for Supply Chain Management will be addressed as they are part in many commercial SCM tools for strategic planning tasks.

Basic literature
Elective literature:

- Daskin: Network and Discrete Location: Models, Algorithms, and Applications, Wiley, 1995
- Domschke, Drexl: Logistik: Standorte, 4. Auflage, Oldenbourg, 1996
- Francis, McGinnis, White: Facility Layout and Location: An Analytical Approach, 2nd Edition, Prentice Hall, 1992
- Love, Morris, Wesolowsky: Facilities Location: Models and Methods, North Holland, 1988
- Thonemann: Operations Management - Konzepte, Methoden und Anwendungen, Pearson Studium, 2005

Remarks
The lecture is held in every winter term. The planned lectures and courses for the next three years are announced online.

Course: Statistical Methods in Financial Risk Management [2521353]

Coordinators: A. Nazemi
Part of the modules: Statistical Methods in Risk Management (p. 125)[MATHMW4STAT2], Mathematical and Empirical Finance (p. 124)[MATHMWSTAT1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1		en

Learning Control / Examinations

Conditions
None.

Learning Outcomes
The student

- is familiar with probability distributions and stable distributions
- knows the estimation methodologies and Copulas,
- is able to model time series data,
- learns Value-at-Risk (VAR) and Asset-Liability Management, Stress testing and Risk Metrics,
- is familiar with portfolio optimization,
- knows Market risk, Credit risk and Operational risk,
- is familiar with Basel Regulations,
- Works with real financial data in R and Matlab.

Content
Part 1: Financial Risk Management: Risk Indicators at Instrumental Level; (Single Fixed Flow, Fixed Rate Bond, FRA, Interest Rate Futures, Interest Rate Swaps, FX Spot, FX Forward, Plain Vanilla Options), Credit Risk, Risk Indicators at the Portfolio Level (Pricing Environment, Interest Rate Factors, FX Factors), Value-at-Risk (VAR) and Asset-Liability Management, Risk Metrics - Market Risk in a Single Position, Measures of Market Risk: (Linear and Non-linear Positions), Market Risk Limits, Calibrating Valuation and Risk Models Performance Evaluation, Probability Distributions and Statistical Assumptions Forecasting Volatilities and Correlations (Basic Design, Ex-post Estimation, Ex-ante Estimation - Forecasting, Defining the Optimal Decay Factor), Assessing Performance (Univariate and Multivariate Tail Probabilities), Mathematics of Structures Monte Carlo (Generating Statistics, Properties of the Correlation Matrix), Mapping Algorithms (Fixed Income, Foreign Exchange, Commodities, Options). Models for Credit Risk. Introduction to Operational Risk
Part 2: Optimal portfolio management: portfolio construction, long/short investing, transaction costs and turnover, performance analysis, asset allocation, benchmark timing. Integrating the equity portfolio management process, active versus passive portfolio management, tracking error (backward-looking versus forward looking tracking error, the impact of portfolio size, benchmark volatility and portfolio betas on tracking error), equity style management (types of equity styles, style classification system), passive strategies(constructing an index portfolio, index tracking and cointegration), active investing (top-down and bottom-up approaches to active investing, fundamental law of active management, strategies based on technical analysis, technical analysis and statistical pattern recognition, market-neutral strategies and statistical arbitrage), Application of Multifactor Risk Models(Risk Decomposition, Portfolio construction and Risk Control, Assessing the exposure of a portfolio, Risk control against a stock-market index, Tilting a portfolio).

Media
transparencies, exercises.

Basic literature

- Fat-Tailed and Skewed Asset Return Distributions: Implications for Risk Management, Portfolio selection, and Option Pricing, Rachev, S., Menn C. and Fabozzi F. , John Wiley, Finance, 2005
- Financial Optimization, by Stavros A. Zenios, 1993, Cambridge University Press.
- The Mathematics of Financial Modeling and Investment Management, by Sergio Focardi and Frank Fabozzi, 2004, Wiley

Remarks
URL: http://statistik.econ.kit.edu/

Course: Statistics and Econometrics in Business and Economics [2521325/2521326]

Coordinators: W. Heller
Part of the modules: Statistical Methods in Risk Management (p. 125)[MATHMW4STAT2]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/2	Winter term	de

Learning Control / Examinations
See German version.

Conditions
Basic knowledge in statistics is required.

Learning Outcomes
statistically accurate use of financial market data, particularly time series analysis
Evaluation of various time series models and their applicability

Content
In Part 1 we will provide a thorough description of the quantitative part of investment theory paying attention to the mathematical, probabilistic and statistical methods now widely used in financial practice.
In Part 2 we shall study the methods of construction, identification and verification of te time-series models, which are among most powerful instruments of the financial econometrics. The emphasis will be on the financial and economic indicators forecasting the financial time-series.

Media
transparencies lecture

Basic literature
e.g.

- Franke/Härdle/Hafner : Einführung in die Statistik der Finanzmärkte.
- Ruppert: Statistics and Finance
- Cochran J.H. : Time Series for Macroeconomics and Finance

Elective literature:
See reading list

Course: Statistics [Stat]

Coordinators: N. Henze, B. Klar
Part of the modules: Statistics (p. 89)[MATHWMST05]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Stochastic Control [MATHST12]

Coordinators: N. Bäuerle
Part of the modules: Stochastic Control (p. 96)[MATHMWST12]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Stochastic and Econometric Models in Credit Risk Management [2520337]

Coordinators: Y. Kim
Part of the modules: Statistical Methods in Risk Management (p. 125)[MATHMW4STAT2]

ECTS Credits	Hours per week	Term	Instruction language
5	2/2	Summer term	en

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content
The deregulation of European markets and the advent of monetary union has resulted in greater liquidity and more competition, creating a truly homogeneous European credit market. Second, given the low level of nominal interest rates, investors are willing to take on more credit risk to boost returns. Third, the regulatory authorities are set to accept the use of internal models for risk management. This will enable banks to better identify and measure credit risk and therefore manage it more effectively.
The course is intended as a mathematically rigorous introduction to the stochastic and econometric models used in credit risk modeling. We will start with a review on term-structure models, and then continue with pricing credit risk and credit risk derivatives using

- firm's value models,
- intensity models,
- pricing credit derivatives.

Basic literature
David Lando, Credit Risk Modeling: Theory and Applications, Princeton Series in Finance, 2004
Philipp J. Schönbucher, Credit Derivatives Pricing Models: Model, Pricing and Implementation, Wiley-Finance, 2003
Darrell Duffie, Kenneth J. Singleton, Credit Risk: Pricing, Measurement and Management, Princeton Series in Finance, Princeton University Press, 2003

Remarks
The course Stochastic and Econometric Models in Credit Risk Management [2520337] will no longer be offered . The examination will be offered latest until summer term 2014.

Course: Stochastic Calculus and Finance [2521331]

Coordinators: W. Heller, M. Safarian
Part of the modules: Mathematical and Empirical Finance (p. 124)[MATHMWSTAT1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Winter term	de

Learning Control / Examinations

Conditions

None.

Learning Outcomes

After successful completion of the course students will be familiar with many common methods of pricing and portfolio models in finance. Emphasis we be put on both finance and the theory behind it.

Content

The course will provide rigorous yet focused training in stochastic calculus and finance. The program will cover modern approaches in stochastic calculus and mathematical finance. Topics to be covered:

1. Stochastic Calculus. Stochastic Processes, Brownian Motion and Martingales, Stopping Times, Local martingales, Doob-Meyer Decomposition, Quadratic Variation, Stochastic Integration, Ito Formula, Girsanov Theorem, Jump-diffusion Processes. Stable and tempered stable processes. Levy processes.
2. Mathematical Finance: Pricing Models. The Black-Scholes Model, State prices and Equivalent Martingale Measure, Complete Markets and Redundant Security Prices, Arbitrage Pricing with Dividends, Term-Structure Models (One Factor Models, Cox-Ingersoll-Ross Model, Affine Models), Term-Structure Derivatives and Hedging, Mortgage-Backed Securities, Derivative Assets (Forward Prices, Future Contracts, American Options, Look-back Options), Option pricing with tempered stable and Levy-Processes and volatility clustering, Optimal Portfolio and Consumption Choice (Stochastic Control and Merton continuous time optimization problem), Equilibrium models, Consumption-Based CAPM, Numerical Methods.

Media

transparencies, exercises.

Basic literature

To be announced in lecture.

Elective literature:

- Dynamic Asset Pricing Theory, Third Edition. by Darrell Duffie, Princeton University Press, 1996
- Stochastic Calculus for Finance II: Continuous-Time Models, by Steven E. Shreve , Springer, 2003
- An Introduction to Stochastic Integration (Probability and its Applications) by Kai L. Chung , Ruth J. Williams , Birkhaueser,
- Methods of Mathematical Finance by Ioannis Karatzas , Steven E. Shreve , Springer 1998
- Kim Y.S. ,Rachev S.T. ,Bianchi M-L, Fabozzi F. Financial market models with Levy processes and time-varying volatility, Journal of Banking and Finance, 32/7,1363-1378, 2008.
- Hull, J., Options, Futures, & Other Derivatives, Prentice Hall, Sixth Edition, (2005).

Course: Stochastic Differential Equations [MATHAN24]

Coordinators: R. Schnaubelt, L. Weis
Part of the modules: Stochastic Differential Equations (p. 50)[MATHMWAN24]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Markov Decision Models I [2550679]

Coordinators: K. Waldmann
Part of the modules: Stochastic Methods and Simulation (p. 129)[MATHMWOR7], Methodical Foundations of OR (p. 128)[MATHMWOR6], Stochastic Modelling and Optimization (p. 133)[MATHMWOR10]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1/2	Winter term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following Section 4(2), 1 of the examination regulation. Credit from the voluntary computer lab is accounted for in the overall grade raising the exam grade by a 2/3 step of a full grade (according to Section 4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
The participants will be enabled to model and analyze stochastic systems with modern techniques. The discussion of practice-oriented case studies pursues two goals. On the one hand, typical problem settings are illustrated and on the other hand, criteria for the evaluation of the performance of stochastic systems are motivated. Properties and characteristics for the evaluation of the performance of Markov Chains, Poisson Processes and queuing systems are developed.

Content
Markov Chains, Poisson Processes, Markov Chains in Continuous Time, Queuing Systems

Media
Blackboard, Slides, Flash Animations, Simulation Software

Basic literature

- Waldmann, K.H., Stocker, U.M. (2012): Stochastische Modelle - eine anwendungsorientierte Einführung, Springer, 2. Auflage
- Elective literature:
  - Norris, J.R. (1997): Markov Chains; Cambridge University Press
  - Bremaud, P. (1999): Markov Chains, Gibbs Fields, Monte Carlo Simulation and Queues, Springer

Course: Markov Decision Models II [2550682]

Coordinators: K. Waldmann
Part of the modules: Stochastic Modelling and Optimization (p. 133)[MATHMWOR10], Stochastic Methods and Simulation (p. 129)[MATHMWOR7]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1/2	Summer term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following Section 4(2), 1 of the examination regulation. Credit from the voluntary computer lab is accounted for in the overall grade raising the exam grade by a 2/3 step of a full grade (according to Section 4(2), 3 of the examination regulation).

Conditions
Foundations in the field of the Markov Decision Models I [2550679] are desired.

Learning Outcomes
The participants will be enabled to utilize Markov Decision Processes as a method for analyzing, controlling and optimizing dynamic stochastic systems. The discussion of practice-oriented case studies in the area of the management of energy systems, revenue management and logistics illustrates the application fields of Markov Decision Processes. Necessary mathematical concepts like theoretical foundations, optimality criteria and the solution of the optimality equation are presented.
Particularly the development of simple structured decision rules, that are desired by practitioners on the one hand, and that permit the efficient solutions of the optimality equation on the other hand, are discussed. The facultative computer exercise course using the programming language Java comprises a practice-oriented case study that illustrates the opportunities of the optimization of stochastic systems.

Content
Queuing Systems, Stochastic Decision Processes

Media
Blackboard, Slides, Flash Animations, Simulation Software

Basic literature

- Waldmann, K.H., Stocker, U.M. (2012): Stochastische Modelle - eine anwendungsorientierte Einführung, Springer, 2. Auflage
- Elective literature: Puterman, M.L. (1994): Markov Decision Processes: Discrete Stochastic Dynamic Programming; John Wiley

Remarks
The lecture is offered irregularly. The curriculum of the next two years is available online.

Course: Stochastic Evolution Equations [MATHAN40-1]

Coordinators: L. Weis
Part of the modules: Stochastic Evolution Equations (p. 56)[MATHAN40]

ECTS Credits	Hours per week	Term	Instruction language
6	4	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Stochastic Geometry [MATHST06]

Coordinators: D. Hug, G. Last
Part of the modules: Stochastic Geometry (p. 90)[MATHMWST06]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

- Random Sets
- Geometric Point Processes
- Stationarity and Isotropy
- Germ Grain Models
- Boolean Models
- Geometric densities and characteristics
- Random Tessellations

Course: Strategic Brand Management [2571185]

Coordinators: M. Klarmann, J. Blickhäuser
Part of the modules: Marketing Management (p. 115)[MATHMWBWLMAR5]

ECTS Credits	Hours per week	Term	Instruction language
1,5	1/0	Summer term	de

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
See German version.

Content

Course: Strategical Aspects of Energy Economy [2581958]

Coordinators: A. Ardone
Part of the modules: Energy Economics and Technology (p. 113)[MATHMWBWLIIP5]

ECTS Credits	Hours per week	Term	Instruction language
3,5	2/0	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam according to Section 4 (2),1 of the examination regulation.

Conditions
None.

Learning Outcomes
Students

- have in-depth knowledge of current and future technologies for power generation,
- know methods and approaches regarding short- to long-term electricity system planning and market modeling - in particular the cost of generating electricity.

Content
1) Energy supply
1.1 Basic concepts
1.2 Global supply & demand (oil, coal, gas, electricity)
2) Power plant types
2.1 Thermal power plants
2.2 Renewables
3) Cost of electricity generation
3.1 Cost depending on the investment (CAPEX)
3.2 Operational fixed cost (OPEX)
3.3 Variable cost
3.4 Full cost of power generation
4) Electricity markets
4.1 Development of power markets
5) Energy system planning
5.1 basic concepts
5.2 Drivers
5.3 Stages of power planning
5.4 Short-term optimization: dispatch decisions
5.5 Mid-term optimization: fuel procurement and overhaul planning
5.6 Long-term optimization: additions & Retirements
5.7 Mathematical tools for system planning and market modeling

Basic literature
Will be anounced in the lecture.

Course: Strategic and Innovative Decision Making in Marketing [2571165]

Coordinators: B. Neibecker
Part of the modules: Marketing Management (p. 115)[MATHMWBWLMAR5]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).
The examination is offered every semester. Re-examinations are offered at every ordinary examination date.

Conditions
See corresponding module information.

Learning Outcomes
Students have learned the following outcomes and competences:
- To specify the key terms in strategic management and innovation research, based on methodological and behavioral approaches
- To apply statistical tools to analyze and interpret strategic problems in marketing
- To indentify the main research trends
- To analyze and interpret high level academic articles
- To learn interactive skills to work in teams and to follow a goal-oriented approach
- To gain understanding of methodological research to develop concrete plans for marketing decision-making

Content
The course places emphasis on the role of marketing in strategic planning. The planning and implementation stages are discussed using a case study in business portfolio analysis, talking about experience effects, approaches in defining strategic business units. A critical view on market orientation and sustainable competitive advantage is given according to Kumar et al. Further topics are innovation and diffusion models, behavioral approaches to innovative decision processes and a discussion on Porter's single diamond theory and globalization.

Basic literature

- Backhaus, K. und M. Voeth: Industriegütermarketing. München: Vahlen 2010.
- Baier, D. und M. Brusch (Hrsg.): Conjointanalyse. Berlin: Springer 2009.
- Cestre, G. und R. Y. Darmon: Assessing consumer preferences in the context of new product diffusion. In: International Journal of Research in Marketing 15, 1998, 123-135.
- Dunning, J. H.: Internationalizing Porter's Diamond. In: mir Management International Review, Special Issue 1993/2, 7-15.
- Gatignon, H. und T. S. Robertson: Innovative Decision Processes. In: Robertson T. S. und H. H. Kassarjian (Hrsg.), Handbook of Consumer Behavior, Englewood Cliffs: Prentice-Hall 1991.
- Homburg, C. und H. Krohmer: Marketingmanagement. Wiesbaden: Gabler 2009 (4. Aufl. 2012).
- Kuhfeld, W.: Multinomial Logit – Discrete Choice Modeling. SAS Institute, TS-650E (http://support.sas.com4.10.2004)
- Kumar, V., E. Jones, R. Venkatesan und R. P. Leone: Is Market Orientation a Source of Sustainable Competitive Advantage or Simply the Cost of Competing? In: Journal of Marketing 75, 2011, 16-30.
- Lilien, G. L., P. Kotler und K. S. Moorthy: Marketing Models. Englewood Cliffs: Prentice Hall 1992.
- Porter, M. E.: Der Wettbewerb auf globalen Märkten. In: Porter, M. E. (Hrsg.), Globaler Wettbewerb, Gabler 1989, 17-63.
- Porter, M. E.: The Competitive Advantage of Nations. New York: Free Press 1990 (zur Ergänzung).
- Prahalad, C. K.: Weak Signals versus Strong Paradigms. In: Journal of Marketing Research 32, 1995, III-VIII..
- Rugman, A. M. und D'Cruz J. R.: The „Double Diamond" Model of International Competitiveness: The Canadian Experience. In: mir Management International Review, Special Issue 1993/2, 17-39.
- Walker, R.: Analysing the business portfolio in Black & Decker Europe. In: Taylor, B. und J. Harrison (Hrsg.), The Manager's Casebook of Business Strategy, Butterworth-Heinemann: Oxford 1991, 19-36.

Course: Strategic Management of Information Technology [2511602]

Coordinators: T. Wolf
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Summer term	de

Learning Control / Examinations
The assessment of this course is a written or (if necessary) oral examination according to §4(2) of the examination regulation.

Conditions
None.

Learning Outcomes
Students know the outer frame of IT in an enterprise and know which functions IT has within an enterprise. They unterstand the organization and the content of these functions.

Content
The following topics will be covered: strategic planing of ICT, architecture of ICT, overall planning of ICT, outsourcing, operation and controlling of ICT.

Media
Slides, internet resources

Basic literature

- Nolan, R., Croson, D.: Creative Destruction: A Six-Stage Process for Transforming the Organization. Harvard Business School Press, Boston Mass. 1995
- Heinrich, L. J., Burgholzer, P.: Informationsmanagement, Planung, Überwachung, Steuerung d. Inform.-Infrastruktur. Oldenbourg, München 1990
- Nolan, R.: Managing the crises in data processing. Harvard Business Review, Vol. 57, Nr. 2 1979
- Österle, H. et al.: Unternehmensführung und Informationssystem. Teubner, Stuttgart 1992
- Thome, R.: Wirtschaftliche Informationsverarbeitung. Verlag Franz Vahlen, München 1990

Course: Supply Chain Management in the Process Industry [2550494]

Coordinators: S. Nickel
Part of the modules: Operations Research in Supply Chain Management and Health Care Management (p. 130)[MATHMWOR8]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	en

Learning Control / Examinations
The assessment is a 60 minutes written examination (according to §4(2), 1 of the examination regulation) (individual grading), case study presentation by student teams (team grading) and classroom participation (individual grading). The examination is held in the term of the lecture.

Conditions
Basic knowledge as conveyed in the module Introduction to Operations Research [WI1OR] is assumed.

Recommendations
Advanced knowledge of Operations Research (e.g., as conveyed in the lectures Facility Location and Strategic SCM, Tactical and operational SCM) is recommended.

Learning Outcomes
The student

- knows and classifies state-of-the art approaches for designing, planning and managing global supply chains in the process industry
- distingusihes quality in supply chains and identifies important building blocks, repeating patterns and concepts crucial to supply chain strategy, design and planning,
- explains specific challenges and approaches towards supply chain operations within the process industry with regards to transportation and warehousing, and describes the interdisciplinary linkage of SCM with information systems, performance management, project management, risk management and sustainability management,
- transfers gained knowledge into practice by using SCM case studies and SCM real life project documentations.

Content
The course ”Supply Chain Management in the Process Industry” covers fundamental concepts in the field of supply chain management with special focus on process industry. Strategic, planning and operational topics within the end-to-end supply chain are examined, covering relevant approaches in design, processes and performance measurement. Additional focus within the course is on showing the interdisciplinary linkages SCM has with information systems, performance management, project management, risk management and sustainability management. The course is enriched by various insights from the world´s leading chemical company BASF, provided by executive management as real life examples and cases.

Basic literature

- Chopra, S./Meindl, P.: Supply Chain Management – Strategy, Planning, & Operations, 4th edition, Upper Saddle River, 2009.
- Various case studies, which will be provided during the course

Remarks
The number of participants is restricted due to the execution of interactive case studies and the resulting examination effort. Due to these capacity restrictions, registration before course start is required according to the information on the course website. The course is planned to be held every winter term. The planned lectures and courses for the next three years are announced online.

Course: Tactical and Operational Supply Chain Management [2550488]

Coordinators: S. Nickel
Part of the modules: Stochastic Methods and Simulation (p. 129)[MATHMWOR7], Operations Research in Supply Chain Management and Health Care Management (p. 130)[MATHMWOR8], Applications of Operations Research (p. 126)[MATHMWOR5]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (120 minutes) according to Section 4(2), 1 of the examination regulation.
The exam takes place in every the semester.
Prerequisite for admission to examination is the succesful completion of the online assessments.

Conditions
Prerequisite for admission to examination is the succesful completion of the online assessments.

Learning Outcomes
The student

- gathers expertise in fundamental techniques from procurement and distribution logistics, methods from inventory management and lot sizing,
- acquires the ability to efficiently utilize quantitative models from transportation planning (long-distance and distribution planning), inventory management and lot sizing in production,
- applies the introduced methods in more detail and in industry-relevant case-studies.

Content
The planning of material transport is an essential element of Supply Chain Management. By linking transport connections across different facilities, the material source (production plant) is connected with the material sink (customer).
The general supply task can be formulated as follows (cf. Gudehus): For given material flows or shipments, choose the optimal (in terms of minimal costs) distribution and transportation chain from the set of possible logistics chains, which asserts the compliance of delivery times and further constraints. The main goal of the inventory management is the optimal determination of order quantities in terms of minimization of fixed and variable costs subject to resource constraints, supply availability and service level requirements. Similarly, the problem of lot sizing in production considers the determination of the optimal amount of products to be produced in a time slot.
The course includes an introduction to basic terms and definitions of Supply Chain Management and a presentation of fundamental quantitative planning models for distribution, vehicle routing, inventory management and lot sizing. Furthermore, case studies from practice will be discussed in detail.

Basic literature
Elective literature:

- Domschke: Logistik: Transporte, 5. Auflage, Oldenbourg, 2005
- Domschke: Logistik: Rundreisen und Touren, 4. Auflage, Oldenbourg, 1997
- Ghiani, Laporte, Musmanno: Introduction to Logistics Systems Planning and Control, Wiley, 2004
- Gudehus: Logistik, 3. Auflage, Springer, 2005
- Simchi-Levi, Kaminsky, Simchi-Levi: Designing and Managing the Supply Chain, 3rd edition, McGraw-Hill, 2008
- Silver, Pyke, Peterson: Inventory management and production planning and scheduling, 3rd edition, Wiley, 1998

Remarks
The lecture is held in every summer term. The planned lectures and courses for the next three years are announced online.

Course: Technological Change in Energy Economics [2581000]

Coordinators: M. Wietschel
Part of the modules: Energy Economics and Technology (p. 113)[MATHMWBWLIIP5]

ECTS Credits	Hours per week	Term	Instruction language
3	2/0	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam.

Conditions
None.

Learning Outcomes
The student

- has an understanding of innovation theory, innovation economy, and innovation systems,
- has skills in different quantitative method for the forecast of technology change in the energy sector, such as technology cycle models, optimization and simulation models as well as indicators and is able to select the adequate approach depending from the task,
- is able to evaluate most important technological developments in the energy sector (energy supply, energy demand, alternative fuels and propulsion systems in the transport sector, and infrastructure (storage, grids)) from a techno-economic perspective.

Content

Course: Theory of Economic Growth [2520543]

Coordinators: M. Hillebrand
Part of the modules: Innovation and growth (p. 117)[MATHMWVWLIWW1]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	en

Learning Control / Examinations
The assessment consists of a 60 min. written exam (according to Section 4 (2), 1 of the examination regulation).
Examinations are confined to the following dates: At the beginning of the recess period (mid July) and of the winter semester (early October).
Please note: There are no further examination dates for this course.

Conditions
None.

Recommendations
Basic knowledge in micro- and macroeconomics, as conveyed in the courses *Economics I: Microeconomics* [2600012] and *Economics II: Macroeconomics* [2600014], is assumed.
Participants are expected to bring a strong interest in mathematical economics and quantitative model building.

Learning Outcomes
See German version.

Content
The field of economic growth strives to analyze and explain the long-run evolution of economies. The aim of this course is to develop models which offer a mathematical description of the growth process and its structural determinants. Starting with the fundamental models by Solow, Kaldor, and Pasinetti, the main focus is on so-called overlapping generations (OLG) models. For this class of models, the theory of deterministic dynamical systems offers a rich set of mathematical tools to analyze the long-run behavior of the economy. In particular, conditions under which the growth path converges, diverges, or exhibits irregular (chaotic) fluctuations can be derived. Building on the insights obtained, a second set of questions deals with how economic policy can foster and stabilize the growth process. In this regard, the impact of governmental debt and intergenerational redistribution schemes such as Social Security on economic growth and welfare are investigated.

Basic literature
Acemoglu, D. (2008): ‘Introduction to Modern Economic Growth’
de la Croix, D. and Michel, P. (2002): ‘A Theory of Economic Growth: Dynamics and Policy in Overlapping Generations’

Remarks
All classes will be held in English.

Course: Topics in Experimental Economics [n.n.]

Coordinators: P. Reiss
Part of the modules: Experimental Economics (p. 123)[MATHMW4VWL17]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Summer term	en

Learning Control / Examinations
The assessment consists of a written exam (following §4(2), 1 of the examination regulation).

Conditions
None.

Recommendations
Basic knowledge of Experimental Economics is assumed. Therefore, it is strongly recommended to attend the course Experimental Economics beforehand.

Learning Outcomes
Students

- are familiar with current research in experimental economics;
- can evaluate the results of an economic experiment and are able to assess its significance in the context of relevant research;
- master advanced methodic issues regarding the experimental method.

Content
The course covers selected topics in experimental economics and deepens the understanding of the experimental method. In particular, topics of current research into experimental and behavioral economics are discussed, along with a treatment of advanced methodic issues.

Media
Slides, problem sets.

Basic literature
A selection of published papers is compulsory reading for the course. The course syllabus provides references and is announced at the beginning of the course.

Remarks
The course is offered in summer 2016 for the first time. The course is not offered in every academic year.

Course: Management and Strategy [2577900]

Coordinators: H. Lindstädt
Part of the modules: Strategic Corporate Management and Organization (p. 114)[MATHMWUO1]

ECTS Credits	Hours per week	Term	Instruction language
3.5	2/0	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (60 min) taking place at the beginn of the recess period (according to §4 (2), 1 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Learning Outcomes
After passing this course students are able to

- prepare strategic decisions along the ideal-typical strategy process in practice ("strategic analysis").
- assess strategic options.
- explain the portfolio management (Parental advantage and best owner of business entities).
- discuss price and capacity decisions in oligopolies and explain them in examples.

Content
The participants learn about central concepts of strategic management along the ideal-typical strategy process: internal and external strategic analysis, concept and sources of competitive advantages, their importance when establishing competitive and corporate strategies as well as strategy assessment and implementation. This aims in particular to provide a summary of the basic concepts and models of strategic management, i.e. to provide in particular an action-oriented integration. Thereby a focus is on imparting knowledge about how price developments in oligopolistic markets can be understood, modeled and forecasted based on game theory.

Media
Slides.

Basic literature

- Grant, R.M.: *Contemporary Strategy Analysis.* Blackwell, 5. Aufl. Massachusetts 2005.
- Lindstädt, H.; Hauser, R.: *Strategische Wirkungsbereiche von Unternehmen.* Gabler, Wiesbaden 2004.

The relevant excerpts and additional sources are made known during the course.

Remarks
The credits for the course "Management and Strategy" have been changed from 4 to 3,5 from summer term 2015 on.

Course: Valuation [2530212]

Coordinators: M. Ruckes
Part of the modules: Finance 1 (p. 109)[MATHMWBWLFBV1], Finance 2 (p. 110)[MATHMWBWLFBV2], Finance 3 (p. 111)[MATH4BWLFBV11]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	en

Learning Control / Examinations

Conditions
None.

Learning Outcomes
Students

- are in a position to evaluate corporate investment projects from a financial point of view,
- are able to value companies,
- are in a position to evaluate the financial consequences of mergers and acquisitions,
- are able to measure the value of flexibility.

Content
Firms prosper when they create value for their shareholders and stakeholders. This is achieved by investing in projects that yield higher returns than their according cost of capital. Students are told the basic tools for firm and project valuation as well as ways to implement these tools in order to enhance a firm's value and improve its investment decisions. Among other things, the course will deal with the valuation of firms and individual projects using discounted cash flow and relative valuation approaches and the valuation of flexibility deploying real options.

Basic literature
Elective literature:
Titman/Martin (2015): Valuation – The Art and Science of Corporate Investment Decisions, 3rd edition, Prentice Hall.

Course: Calculus of variations [MATHAN25]

Coordinators: A. Kirsch, T. Lamm, M. Plum, W. Reichel
Part of the modules: Calculus of variations (p. 51)[MATHMWAN25]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Capability maturity models for software and systems engineering [2511216]

Coordinators: R. Kneuper
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

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

Learning Control / Examinations
The assessment of this course is a written or (if necessary) oral examination according to §4(2) of the examination regulation.

Conditions
None.

Learning Outcomes
Students master the basics of capability maturity models, oversee the whole process in project management and development processes according to CMMI and SPICE. They know how to use capability maturity models for quality assurance.

Content
Capability maturity models like CMMI and SPICE are an important tool for assessing and improving software development. A significantly increasing number of companies use these models in their own approach to improve their development and to demonstrate a certain minimum quality and effective external presentation. This is the case in Germany, especially in the automotive industry, but also many other industries.

Preliminary Structure of the lecture:

1. Introduction and Overview, motivation
2. Project management according to CMMI
3. Development processes according to CMMI
4. Process management and supporting processes according toCMMI
5. Differences between SPICE and CMMI
6. Introduction of capability maturity models
7. Assessments and Appraisals
8. Costs and benefits of capability maturity models

Media
Slides, access to internet resources.

Basic literature
Literature is given in each lecture individually.

Course: Comparison Geometry [MATHAG30]

Coordinators: W. Tuschmann, M. Radeschi
Part of the modules: Comparison Geometry (p. 33)[MATHAG30]

ECTS Credits	Hours per week	Term	Instruction language
5	2/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Behavioral Approaches in Marketing [2572167]

Coordinators: B. Neibecker
Part of the modules: Marketing Management (p. 115)[MATHMWBWLMAR5]

ECTS Credits	Hours per week	Term	Instruction language
4,5	2/1	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).
The examination is offered every semester. Re-examinations are offered at every ordinary examination date.

Conditions
See module description.

Learning Outcomes
Students have learned the following outcomes and competences:

- To specify the key terms in marketing and communication management
- To identify and define theoretical constructs in marketing communication, based on behavioral theory
- To indentify the main research trends
- To analyze and interpret high level academic articles
- To learn interactive skills to work in teams and to follow a goal-oriented approach
- To gain understanding of methodological research to develop concrete plans for marketing decision-making

Content
This course gives an introduction to consumer behavior and the influence of cognitive and emotional information processing on consumer decision making. The contribution of advertising response models is considered and faced with social and environmental aspects (e.g. cross-cultural influences) on consumer behavior, mass communication and internet advertising. In addition, a scientific case study on the effectiveness of TV-commercials is discussed. Central issues of the course:
Case Studies in brand management and advertising response.
Psychological factors (research design and test marketing / arousal / effectiveness of TV-commercials as case studies).
Emotions in marketing.
Information processing and retention in memory (schema theory / visual information processing/grounded theory).
Complex advertising response models (attitude towads the ad / attitude towards the brand / persuasion / context effects in learning / decision making / Means-end-theory and strategic advertising).
Social processes (culture / subculture / cross cultural influence / product design).
Neuromarketing.

Basic literature
(Literature is in English and German, see German description)

Course: Forecasting: Theory and Practice I [MATHST25]

Coordinators: T. Gneiting
Part of the modules: Forecasting: Theory and Practice I (p. 105)[MATHST25]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Forecasting: Theory and Practice II [MATHST26]

Coordinators: T. Gneiting
Part of the modules: Forecasting: Theory and Practice II (p. 106)[MATHST26]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Heat Economy [2581001]

Coordinators: W. Fichtner
Part of the modules: Energy Economics and Technology (p. 113)[MATHMWBWLIIP5]

ECTS Credits	Hours per week	Term	Instruction language
3	2/0	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam according to Section 4(2), 1 of the examination regulation.

Conditions
None.

Learning Outcomes
The student gains detailed knowledge about heat generating technologies and their areas of application, in particular in the area of combined heat and power. The student is able to deal with technical and economic questions in this field.

Content
1. Introduction: Heat economy
2. CHP technologies (incl. calculation of profitability)
3. Heat systems (incl. calculation of profitability)
4. Distribution of heat
5. Demand for space heating and thermal insulation measures
6. Heat storage
7. Legal framework conditions
8. Laboratory experiment: compression heat pump

Media
Media will be provided on the e-learning platform ILIAS.

Course: Probability theory and combinatorial optimization [MATHST27]

Coordinators: D. Hug, G. Last
Part of the modules: Probability theory and combinatorial optimization (p. 107)[MATHST27]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / Summer Term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Traveling Waves [MATHAN38]

Coordinators: J. Rottmann-Matthes
Part of the modules: Traveling Waves (p. 55)[MATHAN38]

ECTS Credits	Hours per week	Term	Instruction language
6	3/1	Winter / Summer Term	

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Wavelets [Wave]

Coordinators: A. Rieder
Part of the modules: Wavelets (p. 65)[MATHMWNM14]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2		

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Seminar Economic Theory [SemWIOR2]

Coordinators: C. Puppe
Part of the modules: Seminar (p. 136)[MATHMWSEM02]

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

Learning Control / Examinations

Conditions
See corresponding module information.
At least one of the courses *Game Theory I* [2520525] and *Welfare Economics* [2520517] should have been attended beforehand.

Learning Outcomes
See German version.

Content

Basic literature
Will be announced at the end of the recess period.

Remarks
see German version.

Course: Workflow-Management [2511204]

Coordinators: A. Oberweis
Part of the modules: Informatics (p. 134)[MATHMWINFO1]

ECTS Credits	Hours per week	Term	Instruction language
5	2/1	Summer term	de

Learning Control / Examinations
The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation in the first week after lecture period.

Conditions
Knowledge of course *Applied Informatics I - Modelling* [2511030] is expected.

Learning Outcomes
Students

- explain the concepts and principles of workflow management concepts and systems and their applications,
- create and evaluatel business process models,
- analyze static and dynamic properties of workflows.

Content
A workflow is that part of a business process which is automatically executed by a computerized system. Workflow management includes the design, modelling, analysis, execution and management of workflows. Workflow management systems are standard software systems for the efficient control of processes in enterprises and organizations. Knowledge in the field of workflow management systems is especially important during the design of systems for process support.
The course covers the most important concepts of workflow management. Modelling and design techniques are presented and an overview about current workflow management systems is given. Standards, which have been proposed by the workflow management coalition (WfMC), are discussed. Petri nets are proposed as a formal modelling and analysis tool for business processes. Architecture and functionality of workflow management systems are discussed. The course is a combination of theoretical foundations of workflow management concepts and of practical application knowledge.

Media
Slides, Access to internet resources.

Basic literature

- W. van der Aalst, H. van Kees: Workflow Management: Models, Methods and Systems, Cambridge 2002: The MIT Press
- M. Weske: Business Process Management: Concepts, Languages, Architectures. Springer 2012.
- A. Oberweis: Modellierung und Ausführung von Workflows mit Petri-Netzen. Teubner-Reihe Wirtschaftsinformatik, B.G. Teubner Verlag, 1996.
- F. Schönthaler, G.Vossen, A. Oberweis, T. Karl: Business Processes for Business Communities: Modeling Languages, Methods, Tools. Springer 2012.
  Further literature is given in the lecture.

Course: Time Series Analysis [MATHST18]

Coordinators: N. Henze, B. Klar
Part of the modules: Time Series Analysis (p. 101)[MATHMWST18]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	Summer term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Universität Karlsruhe (TH)
Forschungsuniversität · gegründet 1825

Der Rektor

Amtliche Bekanntmachung

2009 **Ausgegeben Karlsruhe, den 28. August 2009** **Nr. 76**

I n h a l t **Seite**

Studien- und Prüfungsordnung der Universität Karlsruhe (TH) für den Masterstudiengang Wirtschaftsmathematik

Aufgrund von § 34 Abs. 1, Satz 1 des Landeshochschulgesetzes (LHG) vom 1. Januar 2005 hat die beschließende Senatskommission für Prüfungsordnungen der Universität Karlsruhe (TH) am 13. Februar 2009 die folgende Studien- und Prüfungsordnung für den Masterstudiengang Wirtschaftsmathematik beschlossen.

Der Rektor hat seine Zustimmung am 28. August 2009 erteilt.

Inhaltsverzeichnis

Die Universität Karlsruhe (TH) hat sich im Rahmen der Umsetzung des Bolognaprozesses zum Aufbau eines Europäischen Hochschulraumes zum Ziel gesetzt, dass am Abschluss der Studierendenausbildung an der Universität Karlsruhe (TH) der Mastergrad stehen soll. Die Universität Karlsruhe (TH) sieht daher die an der Universität Karlsruhe (TH) angebotenen konsekutiven Bachelor- und Masterstudiengänge als Gesamtkonzept mit konsekutivem Curriculum.

In dieser Satzung ist nur die weibliche Sprachform gewählt worden. Alle personenbezogenen Aussagen gelten jedoch stets für Frauen und Männer gleichermaßen.

I. Allgemeine Bestimmungen

§ 1 Geltungsbereich, Zweck der Prüfung

(1) Diese Masterprüfungsordnung regelt Studienablauf, Prüfungen und den Abschluss des Studiums im Masterstudiengang Wirtschaftsmathematik an der Universität Karlsruhe (TH).

(2) Im Masterstudium sollen die im Bachelorstudium erworbenen wissenschaftlichen Qualifikationen weiter vertieft oder ergänzt werden. Die Studentin soll in der Lage sein, die wissenschaftlichen Erkenntnisse und Methoden selbstständig anzuwenden und ihre Bedeutung und Reichweite für die Lösung komplexer wissenschaftlicher und gesellschaftlicher Problemstellungen zu bewerten.

§ 2 Akademischer Grad

Aufgrund der bestandenen Masterprüfung wird der akademische Grad „Master of Science“ (abgekürzt: „M.Sc.“) verliehen.

§ 3 Regelstudienzeit, Studienaufbau, Leistungspunkte

(1) Die Regelstudienzeit beträgt vier Semester. Sie umfasst neben den Lehrveranstaltungen Prüfungen und die Masterarbeit.

(2) Die im Studium zu absolvierenden Lehrinhalte sind in Module gegliedert, die jeweils aus einer Lehrveranstaltung oder mehreren, thematisch und zeitlich aufeinander bezogenen Lehrveranstaltungen bestehen. Art, Umfang und Zuordnung der Module zu einem Fach sowie die Möglichkeiten, Module untereinander zu kombinieren, beschreibt der Studienplan. Die Fächer und deren Umfang werden in § 17 definiert.

(3) Der für das Absolvieren von Lehrveranstaltungen und Modulen vorgesehene Arbeitsaufwand wird in Leistungspunkten (Credits) ausgewiesen. Die Maßstäbe für die Zuordnung von Leistungspunkten entsprechen dem ECTS (European Credit Transfer System). Ein Leistungspunkt entspricht einem Arbeitsaufwand von etwa 30 Stunden.

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

(5) Die Verteilung der Leistungspunkte im Studienplan auf die Semester hat in der Regel gleichmäßig zu erfolgen.

(6) Lehrveranstaltungen können auch in englischer Sprache angeboten werden.

§ 4 Aufbau der Prüfungen

(1) Die Masterprüfung besteht aus einer Masterarbeit und Modulprüfungen, jede Modulprüfung aus einer oder mehreren Modulteilprüfungen. Eine Modulteilprüfung besteht aus mindestens einer Erfolgskontrolle.

(2) Erfolgskontrollen sind:

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

Erfolgskontrollen anderer Art sind z.B. Vorträge, Übungsscheine, Projekte, schriftliche Arbeiten, Berichte, Seminararbeiten und Klausuren, sofern sie nicht als schriftliche oder mündliche Prüfung in der Modul- oder Lehrveranstaltungsbeschreibung im Studienplan ausgewiesen sind.

(3) In der Regel sind mindestens 50 % einer Modulprüfung in Form von schriftlichen oder mündlichen Prüfungen (Absatz 2, Nr. 1 und 2) abzulegen, die restlichen Prüfungen erfolgen durch Erfolgskontrollen anderer Art (Absatz 2, Nr. 3). Hiervon ausgenommen sind Seminarmodule.

§ 5 Anmeldung und Zulassung zu den Prüfungen

(1) Um an den Modulprüfungen teilnehmen zu können, muss sich die Studentin schriftlich oder per Online-Anmeldung beim Studienbüro anmelden. Hierbei sind die gemäß dem Studienplan für die jeweilige Modulprüfung notwendigen Studienleistungen nachzuweisen. Darüber hinaus muss sich die Studentin für jede einzelne Modulteilprüfung, die in Form einer schriftlichen oder mündlichen Prüfung (§ 4 Abs. 2, Nr. 1 und 2) durchgeführt wird, beim Studienbüro anmelden. Dies gilt auch für die Anmeldung zur Masterarbeit.

(2) Um zu schriftlichen und/oder mündlichen Prüfungen (§ 4 Abs. 2, Nr. 1 und 2) in einem bestimmten Modul zugelassen zu werden, muss die Studentin vor der ersten schriftlichen oder mündlichen Prüfung in diesem Modul beim Studienbüro eine bindende Erklärung über die Wahl des betreffenden Moduls und dessen Zuordnung zu einem Fach, wenn diese Wahlmöglichkeit besteht, abgeben.

(3) Die Zulassung darf nur abgelehnt werden, wenn die Studentin in einem mit der Wirtschaftsmathematik oder den Wirtschaftswissenschaften vergleichbaren oder einem verwandten Studiengang bereits eine Diplomvorprüfung, Diplomprüfung, Bachelor- oder Masterprüfung endgültig nicht bestanden hat, sich in einem Prüfungsverfahren befindet oder den Prüfungsanspruch in einem solchen Studiengang verloren hat. In Zweifelsfällen entscheidet der Prüfungsausschuss.

§ 6 Durchführung von Prüfungen und Erfolgskontrollen

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

(2) Die Art der Erfolgskontrolle (§ 4 Abs. 2, Nr. 1 bis 3) der einzelnen Lehrveranstaltungen wird von der Prüferin der betreffenden Lehrveranstaltung in Bezug auf die Lehrinhalte der Lehrveranstaltung und die Lehrziele des Moduls festgelegt. Die Prüferin, die Art der Erfolgskontrollen, deren Häufigkeit, Reihenfolge und Gewichtung und die Bildung der Lehrveranstaltungsnote müssen mindestens sechs Wochen vor Semesterbeginn bekannt gegeben werden. Im Einvernehmen zwischen Prüferin und Studentin kann die Art der Erfolgskontrolle auch nachträglich geändert werden. Dabei ist jedoch § 4 Abs. 3 zu berücksichtigen.

(3) Eine schriftlich durchzuführende Prüfung kann auch mündlich, eine mündlich durchzuführende Prüfung kann auch schriftlich abgenommen werden. Diese Änderung muss mindestens sechs Wochen vor der Prüfung bekannt gegeben werden.

(4) Weist eine Studentin nach, dass sie wegen länger andauernder oder ständiger körperlicher Behinderung nicht in der Lage ist, die Erfolgskontrollen ganz oder teilweise in der vorgeschriebenen

Form abzulegen, kann der zuständige Prüfungsausschuss – in dringenden Angelegenheiten, deren Erledigung nicht bis zu einer Sitzung des Ausschusses aufgeschoben werden kann, dessen Vorsitzende – gestatten, Erfolgskontrollen in einer anderen Form zu erbringen. Auf begründeten Antrag kann der Prüfungsausschuss auch in anderen Ausnahmefällen gestatten, Erfolgskontrollen in einer anderen Form zu erbringen.

(5) Bei Lehrveranstaltungen in englischer Sprache können mit Zustimmung der Studentin die entsprechenden Erfolgskontrollen in englischer Sprache abgenommen werden.

(6) Schriftliche Prüfungen (§ 4 Abs. 2, Nr. 1) sind in der Regel von einer Prüferin nach § 15 Abs. 2 oder § 15 Abs. 3 zu bewerten. Die Note ergibt sich aus dem arithmetischen Mittel der Einzelbewertungen. Entspricht das arithmetische Mittel keiner der in § 7 Abs. 2, Satz 2 definierten Notenstufen, so ist auf die nächstliegende Notenstufe zu runden. Bei gleichem Abstand ist auf die nächstbessere Notenstufe zu runden. Das Bewertungsverfahren soll sechs Wochen nicht überschreiten. Schriftliche Einzelprüfungen dauern mindestens 60 und höchstens 240 Minuten.

(7) Mündliche Prüfungen (§ 4 Abs. 2, Nr. 2) sind von mehreren Prüferinnen (Kollegialprüfung) oder von einer Prüferin in Gegenwart einer Beisitzenden als Gruppen- oder Einzelprüfungen abzunehmen und zu bewerten. Vor der Festsetzung der Note hört die Prüferin die anderen an der Kollegialprüfung mitwirkenden Prüferinnen an. Mündliche Prüfungen dauern in der Regel mindestens 15 Minuten und maximal 45 Minuten pro Studentin.

(8) Die wesentlichen Gegenstände und Ergebnisse der mündlichen Prüfung in den einzelnen Fächern sind in einem Protokoll festzuhalten. Das Ergebnis der Prüfung ist der Studentin im Anschluss an die mündliche Prüfung bekannt zu geben.

(9) Studentinnen, die sich in einem späteren Prüfungszeitraum der gleichen Prüfung unterziehen wollen, werden entsprechend den räumlichen Verhältnissen als Zuhörerinnen bei mündlichen Prüfungen zugelassen. Die Zulassung erstreckt sich nicht auf die Beratung und Bekanntgabe der Prüfungsergebnisse. Aus wichtigen Gründen oder auf Antrag der zu prüfenden Studentin ist die Zulassung zu versagen.

(10) Für Erfolgskontrollen anderer Art sind angemessene Bearbeitungsfristen einzuräumen und Abgabetermine festzulegen. Dabei ist durch die Art der Aufgabenstellung und durch entsprechende Dokumentation sicherzustellen, dass die erbrachte Studienleistung der Studentin zurechenbar ist. Die wesentlichen Gegenstände und Ergebnisse einer solchen Erfolgskontrolle sind in einem Protokoll festzuhalten.

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

(12) Bei mündlich durchgeführten Erfolgskontrollen anderer Art muss in der Regel neben der Prüferin eine Beisitzende anwesend sein, die zusätzlich zur Prüferin die Protokolle zeichnet.

§ 7 Bewertung von Prüfungen und Erfolgskontrollen

(1) Das Ergebnis einer Erfolgskontrolle wird von den jeweiligen Prüferinnen in Form einer Note festgesetzt.

(2) Im Masterzeugnis dürfen nur folgende Noten verwendet werden:

1	=	sehr gut (very good)	=	eine hervorragende Leistung,
2	=	gut (good)	=	eine Leistung, die erheblich über den durchschnittlichen Anforderungen liegt,
3	=	befriedigend (satisfactory)	=	eine Leistung, die durchschnittlichen Anforderungen entspricht,

4	=	ausreichend (sufficient)	=	eine Leistung, die trotz ihrer Mängel noch den Anforderungen genügt,
5	=	nicht ausreichend (failed)	=	eine Leistung, die wegen erheblicher Mängel nicht den Anforderungen genügt.

Für die Masterarbeit und die Modulteilprüfungen sind zur differenzierten Bewertung nur folgende Noten zugelassen:

1	1.0, 1.3	=	sehr gut
2	1.7, 2.0, 2.3	=	gut
3	2.7, 3.0, 3.3	=	befriedigend
4	3.7, 4.0	=	ausreichend
5	4.7, 5.0	=	nicht ausreichend

Diese Noten müssen in den Protokollen und in den Anlagen (Transcript of Records und Diploma Supplement) verwendet werden.

(3) Für Erfolgskontrollen anderer Art kann im Studienplan die Benotung mit „bestanden“ (passed) oder „nicht bestanden“ (failed) vorgesehen werden.

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

(5) Jedes Modul, jede Lehrveranstaltung und jede Erfolgskontrolle darf in demselben Studiengang nur einmal angerechnet werden. Die Anrechnung eines Moduls, einer Lehrveranstaltung oder einer Erfolgskontrolle ist darüber hinaus ausgeschlossen, wenn das betreffende Modul, die Lehrveranstaltung oder die Erfolgskontrolle bereits in einem grundständigen Bachelorstudiengang angerechnet wurde, auf dem dieser Masterstudiengang konsekutiv aufbaut.

(6) Erfolgskontrollen anderer Art dürfen in Modulteilprüfungen oder Modulprüfungen nur eingerechnet werden, wenn die Benotung nicht nach Absatz 3 erfolgt ist. Die zu dokumentierenden Erfolgskontrollen und die daran geknüpften Bedingungen werden im Studienplan festgelegt.

(7) Eine Modulteilprüfung ist bestanden, wenn die Note mindestens „ausreichend“ (4.0) ist.

(8) Eine Modulprüfung ist dann bestanden, wenn die Modulnote mindestens „ausreichend“ (4.0) ist. Die Modulprüfung und die Bildung der Modulnote werden im Studienplan geregelt. Die differenzierten Lehrveranstaltungsnoten (Absatz 2) sind bei der Berechnung der Modulnoten als Ausgangsdaten zu verwenden. Enthält der Studienplan keine Regelung darüber, wann eine Modulprüfung bestanden ist, so ist diese Modulprüfung dann endgültig nicht bestanden, wenn eine dem Modul zugeordnete Modulteilprüfung endgültig nicht bestanden wurde.

(9) Die Ergebnisse der Masterarbeit, der Modulprüfungen bzw. der Modulteilprüfungen, der Erfolgskontrollen anderer Art sowie die erworbenen Leistungspunkte werden durch das Studienbüro der Universität erfasst.

(10) Die Noten der Module eines Faches gehen in die Fachnote mit einem Gewicht proportional zu den ausgewiesenen Leistungspunkten der Module ein. Eine Fachprüfung ist bestanden, wenn die für das Fach erforderliche Anzahl von Leistungspunkten nachgewiesen wird.

(11) Die Gesamtnote der Masterprüfung 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

(12) Zusätzlich zu den Noten nach Absatz 2 werden ECTS-Noten für Fachprüfungen, Modulprüfungen und für die Masterprüfung nach folgender Skala vergeben:

ECTS-Note	Quote, Definition
A	gehört zu den besten 10 % der Studierenden, die die Erfolgskontrolle bestanden haben,
B	gehört zu den nächsten 25 % der Studierenden, die die Erfolgskontrolle bestanden haben,
C	gehört zu den nächsten 30 % der Studierenden, die die Erfolgskontrolle bestanden haben,
D	gehört zu den nächsten 25 % der Studierenden, die die Erfolgskontrolle bestanden haben,
E	gehört zu den letzten 10 % der Studierenden, die die Erfolgskontrolle bestanden haben,
FX	*nicht bestanden* (failed) - es sind Verbesserungen erforderlich, bevor die Leistungen anerkannt werden,
F	*nicht bestanden* (failed) - es sind erhebliche Verbesserungen erforderlich.

Die Quote ist als der Prozentsatz der erfolgreichen Studierenden definiert, die diese Note in der Regel erhalten. Dabei ist von einer mindestens fünfjährigen Datenbasis über mindestens 30 Studierende auszugehen. Für die Ermittlung der Notenverteilungen, die für die ECTS-Noten erforderlich sind, ist das Studienbüro der Universität zuständig. Bis zum Aufbau einer entsprechenden Datenbasis wird als Übergangsregel die Verteilung der Diplomsnoten des Diplomstudiengangs Wirtschaftsmathematik per 30. September 2009 zur Bildung dieser Skala für alle Module des Masterstudiengangs Wirtschaftsmathematik herangezogen. Diese Verteilung wird jährlich gleitend über mindestens fünf Semester mit mindestens 30 Studierenden jeweils zu Beginn des Semesters für jedes Modul, die Fachnoten und die Gesamtnote angepasst und in diesem Studienjahr für die Festsetzung der ECTS-Note verwendet.

§ 8 Erlöschen des Prüfungsanspruchs, Wiederholung von Prüfungen und Erfolgskontrollen

(1) Studentinnen können eine nicht bestandene schriftliche Prüfung (§ 4 Abs. 2, Nr. 1) einmal wiederholen. Wird eine schriftliche Wiederholungsprüfung mit „nicht ausreichend“ bewertet, so findet eine mündliche Nachprüfung im zeitlichen Zusammenhang mit dem Termin der nicht bestandenen Prüfung statt. In diesem Falle kann die Note dieser Prüfung nicht besser als „ausreichend“ (4.0) sein.

(2) Studentinnen können eine nicht bestandene mündliche Prüfung (§ 4 Abs. 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. Fehlversuche an anderen Hochschulen sind anzurechnen.

(4) Die Wiederholung einer Erfolgskontrolle anderer Art (§ 4 Abs. 2, Nr. 3) wird im Studienplan geregelt.

(5) Eine zweite Wiederholung derselben schriftlichen oder mündlichen Prüfung ist nur in Ausnahmefällen zulässig. Einen Antrag auf Zweitwiederholung hat die Studentin schriftlich beim Prüfungsausschuss zu stellen. Über den ersten Antrag einer Studentin auf Zweitwiederholung entscheidet der Prüfungsausschuss, wenn er den Antrag genehmigt. Wenn der Prüfungsausschuss diesen Antrag ablehnt, entscheidet die Rektorin. Über weitere Anträge auf Zweitwiederholung entscheidet nach Stellungnahme des Prüfungsausschusses die Rektorin. Absatz 1, Satz 2 und 3 gelten entsprechend.

(6) Die Wiederholung einer bestandenen Erfolgskontrolle ist nicht zulässig.

(7) Eine Fachprüfung ist endgültig nicht bestanden, wenn mindestens ein Modul des Faches endgültig nicht bestanden ist.

(8) Die Masterarbeit kann bei einer Bewertung mit „nicht ausreichend“ einmal wiederholt werden. Eine zweite Wiederholung der Masterarbeit ist ausgeschlossen.

(9) Ist gemäß § 34 Abs. 2, Satz 3 LHG die Masterprüfung bis zum Ende des siebten Fachsemesters dieses Studiengangs einschließlich etwaiger Wiederholungen nicht vollständig abgelegt, so erlischt der Prüfungsanspruch im Studiengang, es sei denn, dass die Studentin die Fristüberschreitung nicht zu vertreten hat. Die Entscheidung darüber trifft der Prüfungsausschuss. Die Entscheidung über eine Fristverlängerung und über Ausnahmen von der Fristregelung trifft der Prüfungsausschuss.

§ 9 Versäumnis, Rücktritt, Täuschung, Ordnungsverstoß

(1) Die Studentin kann bei schriftlichen Modulprüfungen ohne Angabe von Gründen bis einen Tag (24 Uhr) vor dem Prüfungstermin zurücktreten (Abmeldung). Bei mündlichen Modulprüfungen muss der Rücktritt spätestens drei Werktage vor dem betreffenden Prüfungstermin erklärt werden (Abmeldung). Ein Rücktritt von einer mündlichen Prüfung weniger als drei Werktage vor dem betreffenden Prüfungstermin ist nur unter den Voraussetzungen des Absatzes 3 möglich. Die Abmeldung kann schriftlich bei der Prüferin oder per Online-Abmeldung beim Studienbüro erfolgen. Eine durch Widerruf abgemeldete Prüfung gilt als nicht angemeldet. Der Rücktritt von mündlichen Nachprüfungen im Sinne von § 8 Abs. 2 ist grundsätzlich nur unter den Voraussetzungen von Absatz 3 möglich.

(2) Eine Modulprüfung gilt als mit „nicht ausreichend“ bewertet, wenn die Studentin einen Prüfungstermin ohne triftigen Grund versäumt oder wenn sie nach Beginn der Prüfung ohne triftigen Grund von der Prüfung zurücktritt. Dasselbe gilt, wenn die Masterarbeit nicht innerhalb der vorgesehenen Bearbeitungszeit erbracht wird, es sei denn, die Studentin hat die Fristüberschreitung nicht zu vertreten.

(3) Der für den Rücktritt nach Beginn der Prüfung oder das Versäumnis geltend gemachte Grund muss dem Prüfungsausschuss unverzüglich schriftlich angezeigt und glaubhaft gemacht werden. Bei Krankheit der Studentin bzw. eines von ihr allein zu versorgenden Kindes oder pflegebedürftigen Angehörigen kann die Vorlage eines ärztlichen Attestes und in Zweifelsfällen ein amtsärztliches Attest verlangt werden. Die Anerkennung des Rücktritts ist ausgeschlossen, wenn bis zum Eintritt des Hinderungsgrundes bereits Prüfungsleistungen erbracht worden sind und nach deren Ergebnis die Prüfung nicht bestanden werden kann. Wird der Grund anerkannt, wird ein neuer Termin anberaumt. Die bereits vorliegenden Prüfungsergebnisse sind in diesem Fall anzurechnen. Bei Modulprüfungen, die aus mehreren Prüfungen bestehen, werden die Prüfungsleistungen dieses Moduls, die bis zu einem anerkannten Rücktritt bzw. einem anerkannten Versäumnis einer Prüfungsleistung dieses Moduls erbracht worden sind, angerechnet.

(4) Versucht die Studentin das Ergebnis seiner Modulprüfung durch Täuschung oder Benutzung nicht zugelassener Hilfsmittel zu beeinflussen, gilt die betreffende Modulprüfung als mit „nicht ausreichend“ (5.0) bewertet.

(5) Eine Studentin, die den ordnungsgemäßen Ablauf der Prüfung stört, kann von der jeweiligen Prüferin oder Aufsicht Führenden von der Fortsetzung der Modulprüfung ausgeschlossen werden. In diesem Fall gilt die betreffende Prüfungsleistung als mit „nicht ausreichend“ (5.0) bewertet. In schwerwiegenden Fällen kann der Prüfungsausschuss die Studentin von der Erbringung weiterer Prüfungsleistungen ausschließen.

(6) Die Studentin kann innerhalb einer Frist von einem Monat verlangen, dass Entscheidungen gemäß Absatz 4 und 5 vom Prüfungsausschuss überprüft werden. Belastende Entscheidungen des Prüfungsausschusses sind der Studentin unverzüglich schriftlich mitzuteilen. Sie sind zu begründen und mit einer Rechtsbehelfsbelehrung zu versehen. Der Studentin ist vor einer Entscheidung Gelegenheit zur Äußerung zu geben.

(7) Näheres regelt die Allgemeine Satzung der Universität Karlsruhe (TH) zur Redlichkeit bei Prüfungen und Praktika (‚Verhaltensordnung').

§ 10 Mutterschutz, Elternzeit, Wahrnehmung von Familienpflichten

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

(2) Gleichfalls sind die Fristen der Elternzeit nach Maßgabe des jeweiligen gültigen Gesetzes (BErzGG) auf Antrag zu berücksichtigen. Die Studentin muss bis spätestens vier Wochen vor dem Zeitpunkt, von dem an sie die Elternzeit antreten will, dem Prüfungsausschuss unter Beifügung der erforderlichen Nachweise schriftlich mitteilen, in welchem Zeitraum sie Elternzeit in Anspruch nehmen will. Der Prüfungsausschuss hat zu prüfen, ob die gesetzlichen Voraussetzungen vorliegen, die bei einer Arbeitnehmerin den Anspruch auf Elternzeit auslösen würden, und teilt der Studentin das Ergebnis sowie die neu festgesetzten Prüfungszeiten unverzüglich mit. Die Bearbeitungszeit der Masterarbeit kann nicht durch Elternzeit unterbrochen werden. Die gestellte Arbeit gilt als nicht vergeben. Nach Ablauf der Elternzeit erhält die Studentin ein neues Thema.

(3) Der Prüfungsausschuss entscheidet auf Antrag über die flexible Handhabung von Prüfungsfristen entsprechend den Bestimmungen des Landeshochschulgesetzes, wenn Studierende Familienpflichten wahrzunehmen haben. Die Bearbeitungszeit der Masterarbeit kann nicht durch die Wahrnehmung von Familienpflichten unterbrochen oder verlängert werden. Die gestellte Arbeit gilt als nicht vergeben. Die Studentin erhält ein neues Thema, das innerhalb der in § 11 festgelegten Bearbeitungszeit zu bearbeiten ist.

§ 11 Masterarbeit

(1) Die Masterarbeit soll zeigen, dass die Studentin in der Lage ist, ein Problem aus ihrem Fach selbstständig und in begrenzter Zeit nach wissenschaftlichen Methoden, die dem Stand der Forschung entsprechen, zu bearbeiten. Die Masterarbeit kann auf Deutsch oder Englisch geschrieben werden.

(2) Zum Modul Masterarbeit wird zugelassen, wer mindestens 70 Leistungspunkte gesammelt hat.

(3) Die Masterarbeit kann von jeder Prüferin nach § 15 Abs. 2 aus den Fakultäten für Mathematik oder Wirtschaftswissenschaften vergeben werden. Soll die Masterarbeit außerhalb der Fakultäten für Mathematik oder Wirtschaftswissenschaften angefertigt werden, so bedarf dies der Genehmigung des Prüfungsausschusses. Der Studentin ist Gelegenheit zu geben, für das Thema Vorschläge zu machen. Auf Antrag der Studentin sorgt ausnahmsweise die Vorsitzende des Prüfungsausschusses dafür, dass die Studentin innerhalb von vier Wochen nach Antragstellung von einer Betreuerin ein Thema für die Masterarbeit erhält. Die Ausgabe des Themas erfolgt in diesem Fall über die Vorsitzende des Prüfungsausschusses.

(4) Der Masterarbeit werden 30 Leistungspunkte zugeordnet. Die Bearbeitungsdauer beträgt sechs Monate. Thema, Aufgabenstellung und Umfang der Masterarbeit sind von der Betreuerin so zu begrenzen, dass sie mit dem in Satz 1 festgelegten Arbeitsaufwand bearbeitet werden kann. Auf begründeten Antrag der Studentin kann der Prüfungsausschuss diesen Zeitraum um höchstens drei Monate verlängern.

(5) Bei der Abgabe der Masterarbeit hat die Studentin schriftlich zu versichern, dass sie die Arbeit selbstständig verfasst hat und keine anderen als die von ihr angegebenen Quellen und Hilfsmittel benutzt hat, die wörtlich oder inhaltlich übernommenen Stellen als solche kenntlich gemacht und die Satzung der Universität Karlsruhe (TH) zur Sicherung guter wissenschaftlicher Praxis in der jeweils gültigen Fassung beachtet hat. Wenn diese Erklärung nicht enthalten ist, wird die Arbeit nicht angenommen. Bei Abgabe einer unwahren Versicherung wird die Masterarbeit mit „nicht ausreichend“ (5.0) bewertet.

(6) Der Zeitpunkt der Ausgabe des Themas der Masterarbeit und der Zeitpunkt der Abgabe der Masterarbeit sind aktenkundig zu machen. Die Studentin kann das Thema der Masterarbeit nur einmal und nur innerhalb der ersten zwei Monate der Bearbeitungszeit zurückgeben. Wird die Masterarbeit nicht fristgerecht abgeliefert, gilt sie als mit „nicht ausreichend“ bewertet, es sei denn, dass die Studentin dieses Versäumnis nicht zu vertreten hat. Die Möglichkeit der Wiederholung wird in § 8 geregelt.

(7) Die Masterarbeit wird von einer Betreuerin sowie in der Regel von einer weiteren Prüferin aus den beteiligten Fakultäten begutachtet und bewertet. Eine der beiden muss Hochschullehrerin sein. Bei nicht übereinstimmender Beurteilung der beiden Prüferinnen setzt der Prüfungsausschuss im Rahmen der Bewertung der beiden Prüferinnen die Note der Masterarbeit fest. Der Bewertungszeitraum soll acht Wochen nicht überschreiten.

§ 12 Berufspraktikum

(1) Die Studentin kann während des Masterstudiums ein Berufspraktikum ableisten, welches geeignet ist, der Studentin eine Anschauung von der Verzahnung mathematischer und wirtschaftswissenschaftlicher Sichtweisen zu vermitteln. Dem Berufspraktikum sind 8 Leistungspunkte zugeordnet.

(2) Die Studentin setzt sich in eigener Verantwortung mit geeigneten privaten bzw. öffentlichen Einrichtungen in Verbindung, an denen das Praktikum abgeleistet werden kann. Die Studentin wird dabei von einer Prüferin nach § 15 Abs. 2 und einer Ansprechpartnerin der betroffenen Einrichtung betreut.

(3) Am Ende des Berufspraktikums ist der Prüferin ein kurzer Bericht abzugeben und eine Kurzpräsentation über die Erfahrungen im Berufspraktikum zu halten.

(4) Das Berufspraktikum ist abgeschlossen, wenn eine mindestens sechswöchige Tätigkeit nachgewiesen wird, der Bericht abgegeben und die Kurzpräsentation gehalten wurde. Das Berufspraktikum geht nicht in die Gesamtnote ein. Ein Berufspraktikum kann als Zusatzleistung im Sinne von § 13 Abs. 1 oder im Rahmen des Wahlpflichtfachs gemäß § 17 Abs. 4 erbracht werden.

§ 13 Zusatzleistungen, Zusatzmodule, Schlüsselqualifikationen

(1) Innerhalb der Regelstudienzeit, einschließlich der Urlaubssemester für das Studium an einer ausländischen Hochschule (Regelprüfungszeit), können in einem Modul bzw. Fach auch weitere Leistungspunkte (Zusatzleistungen) im Umfang von höchstens 20 Leistungspunkten pro Studiengang erworben werden. § 3 und § 4 der Prüfungsordnung bleiben davon unberührt. Diese Zusatzleistungen gehen nicht in die Festsetzung der Gesamt-, Fach- und Modulnoten ein. Die bei der Festlegung der Modul- bzw. Fachnote nicht berücksichtigten Leistungspunkte werden als Zusatzleistungen automatisch im Transcript of Records aufgeführt und als Zusatzleistungen gekennzeichnet. Zusatzleistungen werden mit den nach § 7 vorgesehenen Noten gelistet.

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

(3) Die Ergebnisse maximal zweier Module, die jeweils mindestens 9 Leistungspunkte umfassen müssen, werden auf Antrag der Studentin in das Bachelorzeugnis als Zusatzmodule aufgenommen und als Zusatzmodule gekennzeichnet. Zusatzmodule werden bei der Festsetzung der Gesamtnote nicht mit einbezogen. Nicht in das Zeugnis aufgenommene Zusatzmodule werden im Transcript of Records automatisch aufgenommen und als Zusatzmodule gekennzeichnet. Zusatzmodule werden mit den nach § 7 vorgesehenen Noten gelistet.

(4) Neben den verpflichtenden fachwissenschaftlichen Modulen sind Module zu den überfachlichen Schlüsselqualifikationen im Umfang von 3 bis 4 Leistungspunkten Bestandteil eines Masterstudiums. Im Studienplan werden Empfehlungen ausgesprochen, welche Module im Rahmen des Angebots zur Vermittlung der additiven Schlüsselqualifikationen belegt werden sollen.

§ 14 Prüfungsausschuss

(1) Für den Masterstudiengang Wirtschaftsmathematik wird ein Prüfungsausschuss gebildet. Er besteht aus sechs stimmberechtigten Mitgliedern, die jeweils zur Hälfte von der Fakultät für Mathematik und der Fakultät für Wirtschaftswissenschaften bestellt werden: vier Hochschullehrerinnen oder Privatdozentinnen, zwei Vertreterinnen der Gruppe der akademischen Mitarbeiterinnen nach § 10 Abs. 1, Satz 2, Nr. 2 LHG und einer Vertreterin der Studentinnen der Fakultät für Mathematik mit beratender Stimme. Weitere Mitglieder mit beratender Stimme können von den jeweiligen Fakultätsräten bestellt werden. Die Amtszeit der nichtstudentischen Mitglieder beträgt zwei Jahre, die des studentischen Mitglieds ein Jahr.

(2) Die Vorsitzende, ihre Stellvertreterin, die weiteren Mitglieder des Prüfungsausschusses sowie deren Stellvertreterinnen werden von den jeweiligen Fakultätsräten bestellt, die Mitglieder der Gruppe der akademischen Mitarbeiterinnen nach § 10 Abs. 1, Satz 2, Nr. 2 LHG und die Vertreterin der Studentinnen auf Vorschlag der Mitglieder der jeweiligen Gruppe; Wiederbestellung ist möglich. Die Vorsitzende und deren Stellvertreterin müssen Hochschullehrerin sein. Die Vorsitzende des Prüfungsausschusses nimmt die laufenden Geschäfte wahr.

(3) Der Prüfungsausschuss ist zuständig für die Organisation der Modulprüfungen und die Durchführung der ihm durch diese Studien- und Prüfungsordnung zugewiesenen Aufgaben. Er achtet auf die Einhaltung der Bestimmungen dieser Studien- und Prüfungsordnung und fällt die Entscheidung in Prüfungsangelegenheiten. Er entscheidet über die Anrechnung von Studienzeiten, Studienleistungen und Modulprüfungen und übernimmt die Gleichwertigkeitsfeststellung. Er berichtet der jeweiligen Fakultät regelmäßig über die Entwicklung der Prüfungs- und Studienzeiten, einschließlich der Bearbeitungszeiten für die Masterarbeiten und die Verteilung der Gesamtnoten. Er gibt Anregungen zur Reform der Studien- und Prüfungsordnung und der Modulbeschreibungen.

(4) Der Prüfungsausschuss kann die Erledigung seiner Aufgaben für alle Regelfälle auf die Vorsitzende des Prüfungsausschusses übertragen.

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

(6) In Angelegenheiten des Prüfungsausschusses, die eine an einer anderen Fakultät zu absolvierende Prüfungsleistung betreffen, ist auf Antrag eines Mitgliedes des Prüfungsausschusses eine fachlich zuständige und von der betroffenen Fakultät zu nennende Hochschullehrerin oder Privatdozentin hinzuzuziehen. Sie hat in diesem Punkt Stimmrecht.

(7) Belastende Entscheidungen des Prüfungsausschusses sind der Studentin schriftlich mitzuteilen. Sie sind zu begründen und mit einer Rechtsbehelfsbelehrung zu versehen. Widersprüche gegen Entscheidungen des Prüfungsausschusses sind innerhalb eines Monats nach Zugang der Entscheidung schriftlich oder zur Niederschrift beim Rektorat der Universität Karlsruhe (TH) einzulegen.

§ 15 Prüferinnen und Beisitzende

(1) Der Prüfungsausschuss bestellt die Prüferinnen und die Beisitzenden. Er kann die Bestellung der Vorsitzenden übertragen.

(2) Prüferinnen sind Hochschullehrerinnen und habilitierte Mitglieder sowie akademischen Mitarbeiterinnen, denen die Prüfungsbefugnis übertragen wurde. Zur Prüferin und Beisitzenden darf nur bestellt werden, 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 Prüferinnen bestellt werden, wenn die jeweilige Fakultät ihnen eine diesbezügliche Prüfungsbefugnis erteilt hat.

(4) Zur Beisitzenden darf nur bestellt werden, wer einen Masterabschluss in einem Studiengang der Wirtschaftsmathematik oder einen gleichwertigen akademischen Abschluss erworben hat.

§ 16 Anrechnung von Studienzeiten, Anerkennung von Studienleistungen und Modulprüfungen

(1) Studienzeiten und Studienleistungen und Modulprüfungen, die in gleichen oder anderen Studiengängen an der Universität Karlsruhe (TH) oder an anderen Hochschulen erbracht wurden, werden angerechnet, soweit Gleichwertigkeit besteht. Gleichwertigkeit ist festzustellen, wenn Leistungen in Inhalt, Umfang und in den Anforderungen denjenigen des Studiengangs im Wesentlichen entsprechen. Dabei ist kein schematischer Vergleich, sondern eine Gesamtbetrachtung vorzunehmen. Bezüglich des Umfangs einer zur Anerkennung vorgelegten Studienleistung und Modulprüfung werden die Grundsätze des ECTS herangezogen; die inhaltliche Gleichwertigkeitsprüfung orientiert sich an den Qualifikationszielen des Moduls.

(2) Werden Leistungen angerechnet, können die Noten – soweit die Notensysteme vergleichbar sind – übernommen werden und in die Berechnung der Modulnoten und der Gesamtnote einbezogen werden. Liegen keine Noten vor, muss die Leistung nicht anerkannt werden. Die Studentin hat die für die Anrechnung erforderlichen Unterlagen vorzulegen.

(3) Bei der Anrechnung von Studienzeiten und der Anerkennung von Studienleistungen und Modulprüfungen, die außerhalb der Bundesrepublik erbracht wurden, sind die von der Kultusministerkonferenz und der Hochschulrektorenkonferenz gebilligten Äquivalenzvereinbarungen sowie Absprachen im Rahmen der Hochschulpartnerschaften zu beachten.

(4) Absatz 1 gilt auch für Studienzeiten, Studienleistungen und Modulprüfungen, die in staatlich anerkannten Fernstudien- und an anderen Bildungseinrichtungen, insbesondere an staatlichen oder staatlich anerkannten Berufsakademien erworben wurden.

(5) Die Anerkennung von Teilen der Masterprüfung kann versagt werden, wenn in einem Studiengang mehr als die Hälfte aller Erfolgskontrollen und/oder in einem Studiengang mehr als die Hälfte der erforderlichen Leistungspunkte und/oder die Masterarbeit anerkannt werden soll/en. Dies gilt insbesondere bei einem Studiengangwechsel sowie bei einem Studienortwechsel.

(6) Zuständig für die Anrechnungen ist der Prüfungsausschuss. Vor Feststellungen über die Gleichwertigkeit sind die zuständigen Fachvertreterinnen zu hören. Der Prüfungsausschuss entscheidet in Abhängigkeit von Art und Umfang der anzurechnenden Studien- und Prüfungsleistungen über die Einstufung in ein höheres Fachsemester.

II. Masterprüfung

§ 17 Umfang und Art der Masterprüfung

(1) Die Masterprüfung besteht aus den Prüfungen nach Absatz 2, 3 und 4 sowie der Masterarbeit nach Absatz 6.

(2) Es sind Prüfungen aus folgenden Gebieten durch den Nachweis von Leistungspunkten in jeweils einem oder mehreren Modulen abzulegen:

Fach Mathematik:

1. Stochastik: im Umfang von 8 Leistungspunkten,
2. Angewandte und Numerische Mathematik/Optimierung: im Umfang von 8 Leistungspunkten,
3. Analysis: im Umfang von 8 Leistungspunkten.

Des Weiteren sind Prüfungen aus den mathematischen Gebieten Stochastik, Angewandte und Numerische Mathematik/Optimierung, Analysis oder Algebra und Geometrie der Fakultät für Mathematik im Umfang von 12 Leistungspunkten abzulegen.

Fach Wirtschaftswissenschaften:

4. Finance - Risikomanagement - Managerial Economics: im Umfang von 18 Leistungspunkten,

5. Operations Management - Datenanalyse - Informatik: im Umfang von 18 Leistungspunkten.

Die Module, die ihnen zugeordneten Leistungspunkte und die Zuordnung der Module zu den Gebieten und Fächern sind im Studienplan festgelegt. Zur entsprechenden Modulprüfung kann nur zugelassen werden, wer die Anforderungen nach § 5 erfüllt.

(3) Es sind zwei Seminarmodule über je 3 Leistungspunkte nachzuweisen. Dabei muss je ein Seminarmodul aus den beiden beteiligten Fakultäten bestanden werden.

(4) Es sind weiterhin 12 Leistungspunkte zu erbringen, wobei mindestens 8 Leistungspunkte aus den obigen Gebieten 1.-5. oder dem Berufspraktikum kommen müssen und 3 bis 4 Leistungspunkte aus Modulen zu Schlüsselqualifikationen nach § 13 Abs. 4.

(5) Im Studienplan oder Modulhandbuch können darüber hinaus inhaltliche Schwerpunkte definiert werden, denen Module zugeordnet werden können.

(6) Als weitere Prüfungsleistung ist eine Masterarbeit gemäß § 11 anzufertigen.

§ 18 Bestehen der Masterprüfung, Bildung der Gesamtnote

(1) Die Masterprüfung ist bestanden, wenn alle in § 17 genannten Prüfungsleistungen mindestens mit „ausreichend“ bewertet wurden.

(2) Die Gesamtnote der Masterprüfung errechnet sich als ein mit Leistungspunkten gewichteter Notendurchschnitt. Dabei werden alle Prüfungsleistungen nach § 17 mit ihren Leistungspunkten gewichtet.

(3) Hat die Studentin die Masterarbeit mit der Note 1.0 und die Masterprüfung mit einem Durchschnitt von 1.0 abgeschlossen, so wird das Prädikat „mit Auszeichnung“ (with distinction) verliehen. Mit einer Masterarbeit mit der Note 1.0 und bis zu einem Durchschnitt von 1.3 kann auf Antrag an den Prüfungsausschuss das Prädikat „mit Auszeichnung“ (with distinction) verliehen werden.

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

(1) Über die Masterprüfung werden nach Bewertung der letzten Prüfungsleistung eine Masterurkunde und ein Zeugnis erstellt. Die Ausfertigung von Masterurkunde und Zeugnis soll nicht später als sechs Wochen nach der Bewertung der letzten Prüfungsleistung erfolgen. Masterurkunde und Masterzeugnis werden in deutscher und englischer Sprache ausgestellt. Masterurkunde und Zeugnis tragen das Datum der erfolgreichen Erbringung der letzten Prüfungsleistung. Sie werden der Studentin gleichzeitig ausgehändigt. In der Masterurkunde wird die Verleihung des akademischen Mastergrades beurkundet. Die Masterurkunde wird von der Rektorin und der Dekanin unterzeichnet und mit dem Siegel der Universität versehen.

(2) Das Zeugnis enthält die in den Fachprüfungen, den zugeordneten Modulprüfungen und der Masterarbeit erzielten Noten, deren zugeordnete Leistungspunkte und ECTS-Noten und die Gesamtnote und die ihr entsprechende ECTS-Note. Das Zeugnis ist von den Dekaninnen der beteiligten Fakultäten und von der Vorsitzenden des Prüfungsausschusses zu unterzeichnen.

(3) Weiterhin erhält die Studentin als Anhang ein Diploma Supplement in deutscher und englischer Sprache, das den Vorgaben des jeweils gültigen ECTS User’s Guide entspricht. Das Diploma Supplement enthält eine Abschrift der Studiendaten der Studentin (Transcript of Records).

(4) Die Abschrift der Studiendaten (Transcript of Records) enthält in strukturierter Form alle von der Studentin erbrachten Prüfungsleistungen. Sie beinhaltet alle Fächer, Fachnoten und ihre entsprechende ECTS-Note samt den zugeordneten Leistungspunkten, die dem jeweiligen Fach zugeordneten Module mit den Modulnoten, entsprechender ECTS-Note und zugeordneten Leistungspunkten sowie die den Modulen zugeordneten Lehrveranstaltungen samt Noten und zugeordneten Leistungspunkten. Aus der Abschrift der Studiendaten soll die Zugehörigkeit von Lehrveranstaltungen zu den einzelnen Modulen und die Zugehörigkeit der Module zu den einzelnen Fächern deutlich erkennbar sein. Angerechnete Studienleistungen sind im Transcript of Records aufzunehmen.

(5) Die Masterurkunde, das Masterzeugnis und das Diploma Supplement einschließlich des Transcript of Records werden vom Studienbüro der Universität ausgestellt.

III. Schlussbestimmungen

§ 20 Bescheid über Nicht-Bestehen, Bescheinigung von Prüfungsleistungen

(1) Der Bescheid über die endgültig nicht bestandene Masterprüfung wird der Studentin durch den Prüfungsausschuss in schriftlicher Form erteilt. Der Bescheid ist mit einer Rechtsbehelfsbelehrung zu versehen.

(2) Hat die Studentin die Masterprüfung endgültig nicht bestanden, wird ihr auf Antrag und gegen Vorlage der Exmatrikulationsbescheinigung eine schriftliche Bescheinigung ausgestellt, die die erbrachten Prüfungsleistungen und deren Noten sowie die zur Prüfung noch fehlenden Prüfungsleistungen enthält und erkennen lässt, dass die Prüfung insgesamt nicht bestanden ist. Dasselbe gilt, wenn der Prüfungsanspruch erloschen ist.

§ 21 Ungültigkeit der Masterprüfung, Entziehung des Mastergrades

(1) Hat die Studentin bei einer Prüfungsleistung getäuscht und wird diese Tatsache nach der Aushändigung des Zeugnisses bekannt, so können die Noten der Modulprüfungen, bei deren Erbringung die Studentin getäuscht hat, berichtigt werden. Gegebenenfalls kann die Modulprüfung für „nicht ausreichend“ (5.0) und die Masterprüfung für „nicht bestanden“ erklärt werden.

(2) Waren die Voraussetzungen für die Zulassung zu einer Prüfung nicht erfüllt, ohne dass die Studentin darüber täuschen wollte, und wird diese Tatsache erst nach Aushändigung des Zeugnisses bekannt, wird dieser Mangel durch das Bestehen der Prüfung geheilt. Hat die Studentin die Zulassung vorsätzlich zu Unrecht erwirkt, so kann die Modulprüfung für „nicht ausreichend“ (5.0) und die Masterprüfung für „nicht bestanden“ erklärt werden.

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

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

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

(6) Die Aberkennung des akademischen Grades richtet sich nach den gesetzlichen Vorschriften.

§ 22 Einsicht in die Prüfungsakten

(1) Nach Abschluss der Masterprüfung wird der Studentin auf Antrag innerhalb eines Jahres Einsicht in ihre Masterarbeit, die darauf bezogenen Gutachten und in die Prüfungsprotokolle gewährt.

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

(3) Die Prüferin bestimmt Ort und Zeit der Einsichtnahme.

(4) Prüfungsunterlagen sind mindestens fünf Jahre aufzubewahren.

§ 23 In-Kraft-Treten

(1) Diese Studien- und Prüfungsordnung tritt am 1. Oktober 2009 in Kraft.

(2) Studierende, die auf Grundlage der Prüfungsordnung der Universität Karlsruhe (TH) für den Diplomstudiengang Wirtschaftsmathematik vom 15. November 2001 (Amtliche Bekanntmachung der Universität Karlsruhe (TH) Nr. 30 vom 26. November 2001) in der Fassung der Änderungssatzung vom 10. September 2003 (Amtliche Bekanntmachung der Universität Karlsruhe (TH) Nr. 28 vom 20. Oktober 2003) ihr Studium an der Universität Karlsruhe (TH) aufgenommen haben, können einen Antrag auf Zulassung zur Prüfung letztmalig am 30. September 2020 stellen.

Karlsruhe, den 28. August 2009

Professor Dr. sc. tech. Horst Hippler
(Rektor)

Karlsruher Institut für Technologie

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

Amtliche Bekanntmachung

2012 **Ausgegeben Karlsruhe, den 24. September 2012** **Nr. 45**

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

vom 24. September 2012

Aufgrund von § 10 Abs. 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 Gesetzes zur Einführung einer Verfassten Studierendenschaft und zur Stärkung der akademischen Weiterbildung (Verfasste-Studierendenschafts-Gesetz – VerfStudG) in der Fassung vom 10. Juli 2012 (GBl. S. 457, 464), und § 8 Abs. 5 und § 34 Abs. 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 2 des Gesetzes zur Einführung einer Verfassten Studierendenschaft und zur Stärkung der akademischen Weiterbildung (Verfasste-Studierendenschafts-Gesetz – VerfStudG) in der Fassung vom 10. Juli 2012 (GBl. S. 457 ff.), hat der Senat des Karlsruher Instituts für Technologie (KIT) am 16. Juli 2012 die folgende Satzung zur Änderung der Studien- und Prüfungsordnung für den Masterstudiengang Wirtschaftsmathematik vom 28. August 2009 (Amtliche Bekanntmachung des Karlsruher Instituts für Technologie (KIT) Nr. 76 vom 28. August 2009) beschlossen.

Der Präsident hat seine Zustimmung am 24. September 2012 erklärt.

Artikel 1

1. § 7 Abs. 12 wird ersatzlos gestrichen.

2. § 13 Abs. 1 wird wie folgt geändert:

   „**(1)** In einem Modul bzw. Fach können auch weitere Leistungspunkte (Zusatzleistungen) im Umfang von höchstens 20 Leistungspunkten aus dem Gesamtangebot des KIT erworben werden. § 3 und § 4 der Prüfungsordnung bleiben davon unberührt. Diese Zusatzleistungen gehen nicht in die Festsetzung der Gesamt-, Fach- und Modulnoten ein. Die bei der Festlegung der Modul- bzw. Fachnote nicht berücksichtigten Leistungspunkte werden als Zusatzleistungen automatisch im Transcript of Records aufgeführt und als Zusatzleistungen gekennzeichnet. Zusatzleistungen werden mit den nach § 7 vorgesehenen Noten gelistet."

3. § 13 Abs. 3 erhält folgende Fassung:

   „**(3)** Die Ergebnisse maximal dreier Module, die insgesamt nur maximal 20 Leistungspunkte umfassen dürfen, werden auf Antrag der Studentin in das Masterzeugnis als Zusatzmodule aufgenommen und als Zusatzmodule gekennzeichnet. Zusatzmodule werden bei der Festsetzung der Gesamtnote nicht mit einbezogen. Nicht in das Zeugnis aufgenommene Zusatzmodule werden im Transcript of Records automatisch aufgenommen und als Zusatzmodule gekennzeichnet. Zusatzmodule werden mit den nach § 7 vorgesehenen Noten gelistet."

4. § 14 Abs. 1 erhält folgende Fassung:

   „**(1)** Für den Masterstudiengang Wirtschaftsmathematik wird ein Prüfungsausschuss gebildet. Er besteht aus sechs stimmberechtigten Mitgliedern, die jeweils zur Hälfte von der Fakultät für Mathematik und der Fakultät für Wirtschaftswissenschaften bestellt werden: vier Hochschullehrerinnen oder Privatdozentinnen, zwei Vertreterinnen der Gruppe der akademischen Mitarbeiterinnen nach § 10 Abs. 1, Satz 2, Nr. 2 LHG und je einer Vertreterin der Studentinnen der Fakultät für Mathematik und der Fakultät für Wirtschaftswissenschaften mit beratender

Stimme. Weitere Mitglieder mit beratender Stimme können von den jeweiligen Fakultätsräten bestellt werden. Die Amtszeit der nichtstudentischen Mitglieder beträgt zwei Jahre, die der studentischen Mitglieder ein Jahr.“

5. § 17 Abs. 2 wird wie folgt geändert:

   „**(2)** Es sind Prüfungen aus folgenden Gebieten durch den Nachweis von Leistungspunkten in jeweils einem oder mehreren Modulen abzulegen:

   Fach Mathematik:

   1. Stochastik: im Umfang von 8 Leistungspunkten,
   2. Angewandte und Numerische Mathematik/Optimierung oder Analysis: im Umfang von 8 Leistungspunkten.

   Des Weiteren sind Prüfungen aus den mathematischen Gebieten Stochastik, Angewandte und Numerische Mathematik/Optimierung, Analysis oder Algebra und Geometrie der Fakultät für Mathematik im Umfang von 20 Leistungspunkten abzulegen.

   Fach Wirtschaftswissenschaften:

   3. Finance – Risk Management - Managerial Economics: im Umfang von 18 Leistungspunkten,
   4. Operations Management - Datenanalyse - Informatik: im Umfang von 18 Leistungspunkten.

   Die Module, die ihnen zugeordneten Leistungspunkte und die Zuordnung der Module zu den Gebieten und Fächern sind im Studienplan festgelegt. Zur entsprechenden Modulprüfung kann nur zugelassen werden, wer die Anforderungen nach § 5 erfüllt.“

6. § 19 Abs. 2 erhält folgende Fassung:

   „**(2)** Das Zeugnis enthält die in den Fachprüfungen, den zugeordneten Modulprüfungen und der Masterarbeit erzielten Noten, deren zugeordnete Leistungspunkte und die Gesamtnote. Das Zeugnis ist von den Dekaninnen der beteiligten Fakultäten und von der Vorsitzenden des Prüfungsausschusses zu unterzeichnen.“

7. § 19 Abs. 4 wird wie folgt geändert:

   „**(4)** Die Abschrift der Studiendaten (Transcript of Records) enthält in strukturierter Form alle von der Studentin erbrachten Prüfungsleistungen. Sie beinhaltet alle Fächer, Fachnoten samt den zugeordneten Leistungspunkten, die dem jeweiligen Fach zugeordneten Module mit den Modulnoten und zugeordneten Leistungspunkten sowie die den Modulen zugeordneten Lehrveranstaltungen samt Noten und zugeordneten Leistungspunkten. Aus der Abschrift der Studiendaten soll die Zugehörigkeit von Lehrveranstaltungen zu den einzelnen Modulen und die Zugehörigkeit der Module zu den einzelnen Fächern deutlich erkennbar sein. Angerechnete Studienleistungen sind im Transcript of Records aufzunehmen.“

Artikel 2

Diese Satzung tritt am Tage nach ihrer Veröffentlichung in den Amtlichen Bekanntmachungen des Karlsruher Instituts für Technologie (KIT) in Kraft.

Karlsruhe, den 24. September 2012

Professor Dr. Eberhard Umbach
(Präsident)

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