

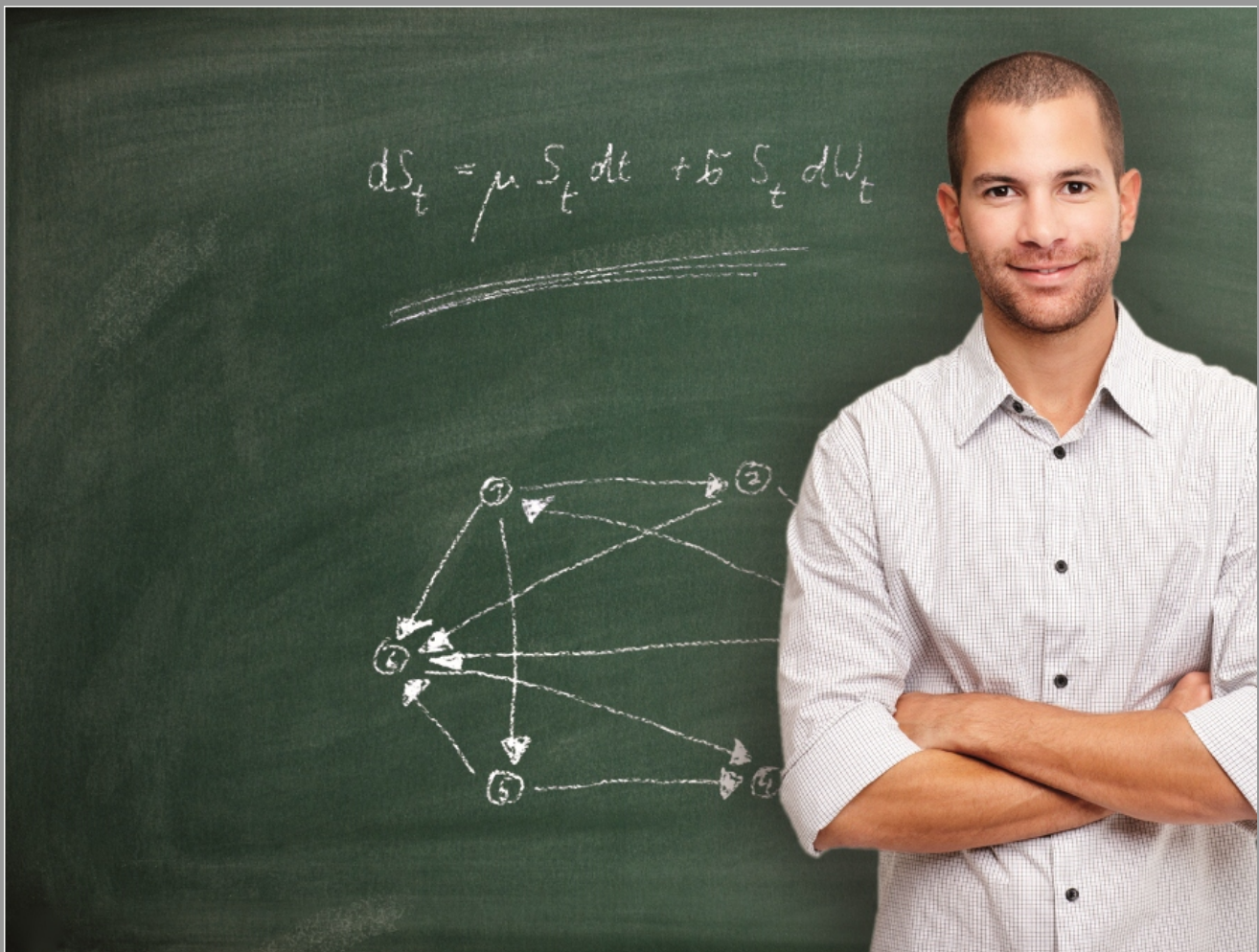
Econometrics (M.Sc.)

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Long version

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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 Ausbildungsziele

Der Masterstudiengang Wirtschaftsmathematik vermittelt

- die vielfältigen interdisziplinären Verzahnungen von Mathematik und Wirtschaftswissenschaften in Theorie und Praxis,
- die Fähigkeit zur mathematischen Modellbildung für wirtschaftswissenschaftliche Problemstellungen sowie zur Interpretation der mathematischen Resultate für die jeweils untersuchte Anwendung,
- fundierte Kenntnisse praxisrelevanter mathematischer Methoden in den Bereichen Stochastik und Optimierung,
- breite Kenntnisse in mathematischen und wirtschaftswissenschaftlichen Fächern sowie spezielle fachliche Vertiefungen bis hin zur aktuellen Forschung,
- die Fähigkeit zum wissenschaftlichen Arbeiten auf dem Gebiet der Wirtschaftsmathematik,
- die Fähigkeit zur Lösung von Anwendungsproblemen mit Computerhilfe,
- die Fähigkeit, sich selbständig in neue Gebiete einzuarbeiten.

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:

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. Die restlichen 20 LP 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.

Wahlbereich 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 und wirtschaftswissenschaftlichen Gebieten oder aus einem Berufspraktikum kommen. 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)	WP (20 LP)	Finance - Risk Management - Managerial Economics (18 LP)
Angewandte und Numerische Mathematik / Optimierung oder Analysis (8 LP)		Operations Management - Datenanalyse - Informatik (18 LP)
Seminar (3 LP)		Seminar (3 LP)
Wahlbereich und Schlüsselqualifikationen (12 LP)		
Masterarbeit (30 LP)		

3 Festlegung des Studienprofils (Schwerpunktbildung)

Im Masterstudiengang Wirtschaftsmathematik wird eines der drei möglichen Studienprofile *Financial Engineering & Actuarial Sciences* 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. Auf Antrag des Studierenden kann das Studienprofil in das Diploma Supplement aufgenommen werden.

Im Folgenden werden Umfang und Inhalt für die einzelnen Studienprofile spezifiziert. Weitere zur Profilbildung zugelassene Module und Vorlesungen werden gegebenenfalls zu Semesterbeginn bekanntgegeben. Dies betrifft insbesondere die von der Fakultät für Mathematik angebotenen Module.

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.

Studienprofil Financial Engineering & Actuarial Sciences

Im Studienprofil *Financial Engineering & Actuarial Sciences* werden Vorlesungen aus moderner Stochastik und Analysis der Fakultät für Mathematik kombiniert mit methodenorientierten Vorlesungen aus dem finanzwirtschaftlichen und aktuarwissenschaftlichen Angebot der Fakultät für Wirtschaftswissenschaften. Die besondere Rolle der Stochastik in diesem Studiengang wird durch die verbindliche Wahl von 16 LP aus diesem Gebiet unterstrichen. Die folgenden Module sind bei diesem Studienprofil zugelassen. Auf Antrag können weitere Module zugelassen werden.

Stochastik (16 LP)

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

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

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

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 methodenorientierten Vorlesungen des Operations Research und der Datenanalyse aus der Fakultät für Wirtschaftswissenschaften. Die folgenden Module sind bei diesem Studienprofil zugelassen. Auf Antrag können weitere Module zugelassen werden.

Stochastik (8 LP)

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

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
Spieltheorie	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
Operational Risk Management I	9 LP
Operational Risk Management II	9 LP
Innovation und Wachstum	9 LP
Konzentration, Konvergenz und Divergenz	9 LP
Strategische Unternehmensführung und Organisation	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

Studienprofil Klassische Wirtschaftsmathematik

Im Studienprofil *Klassische Wirtschaftsmathematik* besteht die größte Freiheit bei der Wahl der Module. Insbesondere sind fast alle Vorlesungen der Fakultät für Mathematik zugelassen. Das aktuelle Angebot kann dem Modulhandbuch entnommen werden. Hier einige Beispiele:

Stochastik (8 LP)

Finanzmathematik in diskreter Zeit	8 LP
Finanzmathematik in stetiger Zeit	8 LP
Statistik	8 LP
Asymptotische Stochastik	8 LP
Räumliche Stochastik	8 LP
Stochastische Geometrie	8 LP
Brownsche Bewegung	4 LP
Generalisierte Regressionsmodelle	4 LP

Perkolation	4 LP
Zeitreihenanalyse	4 LP
Steuerung stochastischer Prozesse	4 LP
Mathematische Statistik	4 LP
Nichtparametrische Statistik	4 LP
Finanzstatistik	4 LP

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
Numerische Methoden in der Finanzmathematik	8 LP
Numerische Methoden für Differentialgleichungen	8 LP
Einführung in das Wissenschaftliche Rechnen	8 LP
Löser für lineare und nichtlineare Gleichungssysteme	8 LP
Wavelets	8 LP
Bildgebende Verfahren in der Medizintechnik	8 LP
Numerische Methoden für zeitabhängige PDGLn	8 LP
Inverse Probleme	8 LP
Funktionalanalysis	8 LP
Variationsrechnung	8 LP
Klassische Methoden für partielle Differentialgleichungen	8 LP
Kontrolltheorie	4 LP
Spieltheorie	4 LP
Stochastische Differentialgleichungen	8 LP
Computerunterstützte analytische Methoden für Rand- und Eigenwertprobleme	8 LP
Evolutionsgleichungen	8 LP
Fourieranalysis	8 LP
Rand- u. Eigenwertprobleme	8 LP
Integralgleichungen	8 LP
Stabilitäts- und Kontrolltheorie für Evolutionsgleichungen	8 LP
Spektraltheorie	8 LP

Die weiteren Leistungspunkte in der Mathematik können auch aus dem Gebiet Algebra und Geometrie stammen.

Algebra und Geometrie (8 LP)

Algebra	8 LP
Algebraische Zahlentheorie	8 LP
Differentialgeometrie	8 LP
Diskrete Geometrie	4 LP
Konvexe Geometrie	8 LP
Algebraische Geometrie	8 LP
Geometrie der Schemata	8 LP
Geometrische Gruppentheorie	8 LP
Lie-Gruppen und Lie-Algebren	8 LP
Symmetrische Räume	8 LP
Geometrische Maßtheorie	8 LP
Graphen und Gruppen	8 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
Operational Risk Management I	9 LP
Operational Risk Management II	9 LP
Innovation und Wachstum	9 LP
Konzentration, Konvergenz und Divergenz	9 LP
Strategische Unternehmensführung und Organisation	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

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* 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 *Spieltheorie I* 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 be 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 losing 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 qualification	Schlüsselqualifikationen
SWS	contact hour	Semesterwochenstunde
Ü	exercise 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.

MATHMWBWLFVB9 - Operational Risk Management I (S. 86)

Anmerkungen

The module Operational Risk Management I will not be offered any more.
Students who are already assigned on the module can still finish it until summer term 2013.
The courses *Risk Management of Microfinance and Private Households* [26354] and *Project Work in Risk Research* [2530393] are offered on demand. For further information, see: <http://insurance.fbv.kit.edu>

MATHMWBWLFVB10 - Operational Risk Management II (S. 87)

Anmerkungen

The module Operational Risk Management II will not be offered any more.
Students who are already assigned on the module can still finish it until summer term 2013.
The courses *Insurance Production* [2530324], and *Service Management* [26327] are offered on demand, according to the students' wishes. For further information, see: <http://insurance.fbv.kit.edu>

2550486 - Facility Location and Strategic Supply Chain Management (S. 287)

Anmerkungen

Due to a research semester in the summer term 2013, the lecture will be held in winter term 2013/2014.
The planned lectures and courses for the next three years are announced online.

2550488 - Tactical and Operational Supply Chain Management (S. 300)

Anmerkungen

The lecture will be held again in summer term 2014.
The planned lectures and courses for the next three years are announced online.

2550493 - Hospital Management (S. 193)

Bedingungen

See German version.

2550490 - Software Laboratory: OR Models I (S. 271)

Anmerkungen

Due to capacity restrictions, registration before course start is required. For further information see the webpage of the course.
In the summer term 2013 the lecture is cancelled due to a research semester.
The planned lectures and courses for the next three years are announced online.

2550497 - Software Laboratory: OR Models II (S. 272)

Anmerkungen

In the summer term 2013 the lecture is cancelled due to a research semester.
The planned lectures and courses for the next three years are announced online.

n.n. - Discrete-event Simulation in Production and Logistics (S. 151)

Anmerkungen

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.

2550484 - Graph Theory and Advanced Location Models (S. 172)

Anmerkungen

The lecture is planned to be held in the winter term 2014/2015. The lecture is not held in summer 2013 due to a research semester.
The planned lectures and courses for the next three years are announced online.

2520543 - Theory of Economic Growth (S. [302](#))

Anmerkungen

All classes will be held in English.

4 Modules

4.1 Modules of Mathematics

Module: Differential Geometry [MATHMWAG04]

Coordination: W. Tuschmann
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 138)	4/2	W	8	O. Baues, S. Grensing, T. Lamm, E. Leuzinger, G. Link, W. Tuschmann

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+2
 Introduction into Geometry and Topology

Learning Outcomes

Introduction to the concepts of Differential Geometry

Content

- manifolds
- Riemannian metrics
- connections
- geodesics
- curvature
- length metrics
- curvature and topology

Module: Algebra [MATHMWAG05]

Coordination: F. Herrlich
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 113)	4/2	W	8	F. Herrlich, C. Schmidt, S. Kühnlein, G. Weitze- Schmithüsen

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+2
 Introduction into Algebra and Number Theory

Learning Outcomes

- Concepts and methods of algebra
- Preparation to seminars and further courses in algebraic geometry and number theory

Content

- Fields:
field extensions, Galois theory, cyclotomic fields
- Valuations:
valuation rings, extension of values, local fields
- Dedekind domains:
integral ring extensions, normal closure, noetherian rings

Module: Discrete Geometry [MATHMWAG06]

Coordination: D. Hug
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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)
1535	Discrete Geometry (p. 139)	4/2		8	D. Hug

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+2

Learning Outcomes

The students

- know fundamental combinatorial properties and results about convex polytopes, geometric graphs and packings,
- understand metric, combinatorial and graph theoretic arguments and apply these in modified form.

Content

- Combinatorial Properties of Convex Sets
- Convex Polytopes
- Geometric Graphs
- Algorithmic Problems
- Packing and Covering
- Lattices

Module: Convex Geometry [MATHMWAG07]

Coordination: D. Hug
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 192)	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

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

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: Geometric Measure Theory [MATHMWAG08]

Coordination: D. Hug
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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)
1040	Geometric Measure Theorie (p. 167)	4/2	W/S	8	D. Hug

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

The students

- know fundamental results and techniques of proof of geometric measure theory,
- know examples of applications of methods of geometric measure theory and apply these methods.

Content

- Measure and integral
- Covering Theorems
- Hausdorff Measures
- Differentiation of Measures
- Lipschitz Functions and Rectifiability
- Area and Coarea Formula
- Currents
- Applications

Module: Algebraic Number Theory [MATHMWAG09]

Coordination: C. Schmidt
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 115)	4/2	W/S	8	S. Kühnlein, C. Schmidt

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

It is recommended to attend the following modules previously:
 Algebra

Learning Outcomes

Introduction to the structures and methods in Algebraic Number Theory

Content

Algebraic number fields,
 Minkowski theory,
 finiteness of the class group,
 Dirichlet's unit theorem,
 local fields

Module: Algebraic Geometry [MATHMWAG10]

Coordination: F. Herrlich
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 114)	4/2	W/S	8	F. Herrlich, S. Kühnlein

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

None.

Recommendations

It is recommended to attend the following modules previously:
 Algebra

Learning Outcomes

Familiarity with the basic concepts of algebraic geometry and the appropriate algebraic tools

Content

Hilbert's base theorem, Nullstellensatz, affine and projective varieties, morphisms and rational maps. nonsingular varieties, algebraic curves, Riemann-Roch theorem

Module: Geometry of Schemes [MATHMWAG11]

Coordination: F. Herrlich
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 165)	4/2	W/S	8	F. Herrlich, S. Kühnlein

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

It is recommended to attend the following modules previously:
 Algebraic Geometry

Learning Outcomes

Familiarity with the language of sheaves and schemes; applications to algebraic geometry

Content

Sheaves of modules;
 affine schemes;
 varieties and schemes;
 morphisms;
 cohomology of schemes

Module: Geometric Group Theory [MATHMWAG12]

Coordination: G. Weitze-Schmithüsen
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 166)	4/2	S	8	F. Herrlich, E. Leuzinger, R. Sauer, G. Weitze-Schmithüsen

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

None.

Recommendations

It is recommended to attend the following modules previously:
 Introduction into Algebra and Number Theory
 Introduction into Geometry and Topology

Learning Outcomes

Understanding of the interplay between geometry and group theory

Content

Module: Lie Groups and Lie Algebras [MATHMWAG13]

Coordination: O. Baues
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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)
MATHAG13	Lie Groups and Lie Algebras (p. 196)	4/2	W/S	8	O. Baues

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

It is recommended to attend the following modules previously:
 Introduction into Geometry and Topology

Learning Outcomes

Introduction to Lie groups and Lie algebras, preparation to seminars and further courses in algebra and geometry

Content

basic notions, special classes of Lie groups and Lie algebras, structure theory, additional and advanced topics

Module: Graphs and Groups [MATHMWAG17]

Coordination: F. Herrlich
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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)
MATHAG17	Graphs and Groups (p. 173)	4/2	W/S	8	F. Herrlich, G. Weitze- Schmithüsen

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

It is recommended to attend the following modules previously:
 Introduction into Algebra and Number Theory
 Introduction into Geometry and Topology

Learning Outcomes

Various relations between graph and group theory,
 familiarity with concepts like Cayley graph and group actions on graphs

Content

Graphs and trees, Cayley graphs, free groups, fundamental group of a graph, free products, amalgams, graphs of groups, Bass-Serre theory, p-adic numbers, Bruhat-Tits tree, discontinuous groups

Module: Symmetric Spaces [MATHMWAG19]

Coordination: E. Leuzinger
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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)
MATHAG19	Symmetric Spaces (p. 299)	4/2	W/S	8	E. Leuzinger

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

None.

Learning Outcomes

Introduction to the theory of symmetric spaces

Content

homogeneous spaces,
 symmetric spaces,
 locally symmetric spaces

Module: Graph Theory [MATHAG26]

Coordination: M. Axenovich
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 174)	4+2	W/S	8	M. Axenovich

Learning Control / Examinations

Examination: written or oral exam
 Marking: grade of examination

Conditions

None.

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.

Module: Combinatorics in the plane [MATHAG28]

Coordination: M. Axenovich
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 112)	3/2	W/S	7	M. Axenovich, T. Ueckerdt

Learning Control / Examinations

Conditions
 None.

Learning Outcomes

Content

Module: Functional Analysis [MATHMWAN05]

Coordination: R. Schnaubelt
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 160)	4/2	W	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.

Recommendations

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

Learning Outcomes

Introduction into functional analytic concepts and methods

Content

- metric spaces (topological concepts, compactness)
- continuous linear operators on Banach spaces (principle of uniform boundedness, open mapping theorem)
- dual spaces, representation theorems theorem of Hahn-Banach, weak convergence, reflexivity
- distributions, weak derivatives, Fourier transform, theorem of Plancherel, Sobolev spaces in L^2 , partial differential equations with constant coefficients

Module: Integral Equations [MATHMWAN07]

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

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. 180)	4/2		8	T. Arens, F. Hettlich, A. Kirsch

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

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

Module: Classical Methods for Partial Differential Equations [MATHMWAN08]

Coordination: M. Plum
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 189)	4/2	W	8	M. Plum, W. Reichel, 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

Learning Outcomes

Content

Module: Boundary Value Problems and Eigenvalue Problems [MATHMWAN09]

Coordination: W. Reichel
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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 Value Problems and Eigenvalue Problems (p. 245)	4/2	S	8	M. Plum, W. Reichel, 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
 Differential Equations and Hilbert Spaces

Learning Outcomes

Profound understanding of concepts and methods in partial differential equations particularly for boundary and eigenvalue problems.

Content

- examples of boundary and eigenvalue problems from physics
- maximum principles for second order equations
- Sobolev spaces
- weak formulation of linear elliptic boundary value problems of second order
- Lax-Milgram lemma
- coercivity
- Fredholm alternative for boundary value problems
- eigenvalue theory for weakly formulated elliptic eigenvalue problems

Module: Spectral Theory [MATHMWAN10]

Coordination: L. Weis
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 275)	4/2	S	8	G. Herzog, 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
 Functional Analysis or Differential Equations and Hilbert Spaces

Learning Outcomes

A deepened understanding of functional analytic concepts and methods in the context of spectral theory.

Content

- Closed operators on Banach spaces
- spectrum und resolvent
- compact operators und Fredholm alternative
- Dunford's functional calculus, spectral projections
- Unbounded selfadjoint operators on Hilbert spaces
- Spectral Theorem
- Operators defined by forms
- Applications to partial differential equations

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

Coordination: M. Plum
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 131)	4/2	W/S	8	M. Plum

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

It is recommended to attend the following modules previously:
 Functional Analysis
 Boundary Value Problems and Eigenvalue Problems

Learning Outcomes

Content

Module: Evolution Equations [MATHMWAN12]

Coordination: R. Schnaubelt
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 152)	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

It is recommended to attend the following modules previously:
 Functional Analysis

Learning Outcomes

The students understand the basic ideas and concepts of the operatortheoretic approach to evolution equations. They can apply these concepts to partial differential equations.

Content

strongly continuous operator semigroups and their generators,
 generation theorems and wellposedness,
 analytic semigroups,
 inhomogeneous and semilinear Cauchy problems,
 perturbation theory,
 introduction to stability and spectral theory of operator semigroups,
 applications to partial differential equations

Module: Game Theory [MATHMWAN13]

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

ECTS Credits	Cycle	Duration
4	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN13	Game Theory (p. 284)	2/1	W/S	4	M. Plum, W. Reichel

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

None.

Learning Outcomes

Students know the foundations of the theory of non-cooperative games and their equilibria on an exemplary basis.

Content

2-person zero-sum games,
 von Neumann-Morgenstern theory,
 n-personen zero-sum games,
 mixed extension,
 Nash equilibria,
 theorem of Nikaido-Isoda

Module: Fourier Analysis [MATHMWAN14]

Coordination: L. Weis
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 159)	4/2	W/S	8	R. Schnaubelt, L. Weis

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

It is recommended to attend the following modules previously:
 Functional Analysis or Differential Equations and Hilbert Spaces

Learning Outcomes

An understanding of function and differential equation in the Fourier representation ("frequency domain"), treatment of singular integrals.

Content

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

Module: Control Theory [MATHMWAN18]

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

ECTS Credits	Cycle	Duration
4	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN18	Control Theory (p. 191)	2/1	W/S	4	R. Schnaubelt, L. Weis

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

Learning Outcomes

The students understand the basic ideas and concepts of control theory at the end of the module. They can apply these ideas and the relevant methods in the framework of ordinary differential equations.

Content

linear ordinary differential equations with control: controllability and observability,
 stabilizability and detectability,
 transfer functions,
 realization theory,
 quadratic optimal control,
 introduction into nonlinear control

Module: Stability and Control Theory for Evolution Equations [MATHMWAN23]

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

ECTS Credits	Cycle	Duration
8	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN23	Stability and Control Theory for Evolution Equations (p. 286)	4/2	W/S	8	R. Schnaubelt, L. Weis

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

It is recommended to attend the following modules previously:

Functional Analysis
 Evolution Equations
 Spectral Theory

Learning Outcomes

The students understand the basic ideas and concepts of the qualitative theory of evolution equations at the end of the module.

Content

stability concepts, dichotomy, spectral theory of operator semigroups,
 criteria for stability and dichotomy,
 linearized stability,
 observability, controllability, stabilizability and detectability for operator semigroups,
 transfer functions

Module: Stochastic Differential Equations [MATHMWAN24]

Coordination: L. Weis
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 290)	4/2	W/S	8	R. Schnaubelt, L. Weis

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

It is recommended to attend the following modules previously:
 Functional Analysis or Differential Equations and Hilbert Spaces

Learning Outcomes

Integrating analytical and stochastic methods in the treatment of dynamical systems in a random environment.

Content

- Brownian motion
- Martingales and Martingale 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: 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. 305)	4/2	W/S	8	A. Kirsch, M. Plum, W. Reichel

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

It is recommended to attend the following modules previously:
 Functional Analysis
 Classical Methods for Partial Differential Equations
 Boundary Value Problems and Eigenvalue Problems

Learning Outcomes

Students know the basic problems of the calculus of variations and are able to formulate variational problems by themselves. They know techniques to prove existence of solutions to variational problems and in special cases they can compute these solutions.

Content

one dimensional variational problems
 Euler-Lagrange equation
 necessary and sufficient criteria
 multidimensional variational problems
 direct methods in the calculus of variations
 existence of critical points of functionals

Module: Methods of Fourier Analysis [MATHAN35]

Coordination: P. Kunstmann
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: Analysis

ECTS Credits	Cycle	Duration
4	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHAN35	Methods of Fourier Analysis (p. 204)	2/1	W/S	4	P. Kunstmann, R. Schnaubelt, L. Weis

Learning Control / Examinations

Conditions
 None.

Learning Outcomes

Content

Module: Numerical Methods for Differential Equations [MATHMWNM03]

Coordination: W. Dörfler, T. Jahnke
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 214)	4/2	W	8	W. Dörfler, V. Heuveline, A. Rieder, C. Wieners

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

None.

Recommendations

It is recommended to attend the following modules previously:
 Analysis 1+2
 Linear Algebra 1+2
 Programming: Introduction into Computer Science
 Numerical Mathematics 1+2

Learning Outcomes

The students know basic methods and algorithms to solve differential equations. All aspects from modelling to questions of stability and convergence will be considered.

Content

1. Initial value problems
 - 1.1. Introduction
 - 1.2. Explicit timestepping
 - 1.3. Timestep control
 - 1.4. Extrapolation
 - 1.5. Multistep methods
 - 1.6. Implicit Timestepping
 - 1.7. Stability
2. Boundary value problems
 - 2.1. Finite difference methods
 - 2.2. Variational methods
3. Introduction into numerical methods for PDEs
 - 3.1. Elliptic Equations
 - 3.2. Parabolic Equations (1-D)
 - 3.3. Hyperbolic Equations (1-D)

Module: Introduction into Scientific Computing [MATHMWNM05]

Coordination: W. Dörfler
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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 into Scientific Computing (p. 144)	3/3	S	8	W. Dörfler, V. Heuveline, M. Hochbruck, T. Jahnke, A. Rieder, C. Wieners

Learning Control / Examinations

exam:

written or oral exam or practical

Marking:

grade of exam

Conditions

None.

Recommendations

It is recommended to attend the following modules previously:

Analysis 1+2

Linear Algebra 1+2

Programming: Introduction into Computer Science

Numerical Mathematics 1+2

Numerical Methods for Differential Equations

Learning Outcomes

Content

Module: Inverse Problems [MATHMWNM06]

Coordination: A. Kirsch
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 188)	4/2	W	8	T. Arens, F. Hettlich, A. Kirsch, A. Rieder

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
 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

Module: Parallel Computing [MATHMWNM08]

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

ECTS Credits	Cycle	Duration
5	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHNM08	Parallel Computing (p. 229)	2/2	W/S	5	V. Heuveline, J. Weiß

Learning Control / Examinations

prerequisite:
 weekly work assignments in practice,
 exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

None.

Learning Outcomes

- Basic skills in parallel computing
- Overview over scientific computing on massively parallel computers
- experiences in programming paradigms (theoretical and practical)
- scaleable implementation of simple applied problems

Content

- Introduction and motivation (scalar product, sorting, PDEs)
- Computer architecture and storage hierarchy
- measuring performance
- programming paradigms: MPI and Open MPI
- parallel solvers for linear systems
- libraries
- load sharing
- Finite difference method for the Laplace problem

Module: Optimization and Optimal Control for Differential Equations [MATHMWNM09]

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

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)
MATHNM09	Optimization and Optimal Control for Differential Equations (p. 222)	2/1	S	4	V. Heuveline

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

None.

Learning Outcomes

- to gain an overview on optimal control and modelling
- adequate understanding of the functional analytical frame
- basic skills in solving elliptic and parabolic problems

Content

- Introduction and motivation
- linear-quadratic elliptic problems
- parabolic problems
- optimal control for semilinear elliptic equations
- semilinear parabolic equations

Module: Solvers for linear and nonlinear systems of equations [MATHMWNM10]

Coordination: C. Wieners
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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)
LLNGS	Solution methods for linear and nonlinear equations (p. 197)	4/2	S	8	W. Dörfler, A. Rieder, C. Wieners

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
 Numerical mathematics 1+2

Learning Outcomes

The students become acquainted with numerical solution methods for linear and nonlinear systems. They learn algorithms, results on convergence, and representative applications.

Content

- Direct solution methods for linear systems
- Iterative methods for linear systems
- Multigrid and domain decomposition methods
- Fixpoint and Newton Methods for nonlinear equations

Module: Wavelets [MATHMWNM14]

Coordination: A. Rieder
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 308)	4/2		8	A. Rieder

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

The students get to know the mathematical properties of the integral and discrete wavelet transform. They will be enabled to employ the wavelet transform as an analytic tool in signal- and image-processing.

Content

- windowed (short time) Fourier transform
- integral wavelet transform
- wavelet frames
- wavelet bases
- fast wavelet transform
- construction of orthogonal and bi-orthogonal wavelets
- applications in signal- and image-processing

Module: Medical imaging [MATHMWNM15]

Coordination: A. Rieder
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 123)	4/2	W/S	8	A. Rieder

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

It is recommended to attend the following modules previously:
 Functional Analysis

Learning Outcomes

The students get to know some mathematical models in medical imaging, their properties and their numerical realization (reconstruction algorithms). They will be enabled to apply the learned techniques to similar problems.

Content

- models of computerized tomography (X-ray, impedance, etc.)
- sampling and resolution
- ill-posedness and regularization
- reconstruction algorithms

Module: Numerical Methods in Mathematical Finance [MATHMWNM18]

Coordination: T. Jahnke
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 216)	4/2	W/S	8	T. Jahnke, C. Wieners

Learning Control / Examinations

exam:
written or oral exam

Marking:
grade of exam

Conditions

It is recommended to attend the following modules previously:
 Numerical Methods for Differential Equations
 Probability Theory

Learning Outcomes**Content**

Module: Numerical Methods for Time-Dependent PDE [MATHMWNM20]

Coordination: W. Dörfler
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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 PDE (p. 215)	4/2	W/S	8	W. Dörfler

Learning Control / Examinations

exam:
written or oral exam

Marking:
grade of exam

Conditions

It is recommended to attend the following modules previously:
Finite Element Methods

Learning Outcomes

The students are able to

- establish a discretisation for a time-dependent partial differential equation,
- predict the convergence behaviour and verify it numerically,
- understand the implementation techniques.

Content

1. Numerical methods for parabolic equations
2. Numerical methods for hyperbolic equations
3. Adaptive timestepping methods

Module: Numerical Optimization Methods [MATHMWNM25]

Coordination: C. Wieners
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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 Optimization Methods (p. 218)	4/2	W/S	8	V. Heuveline, C. Wieners

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

It is recommended to attend the following modules previously:
 Optimization Theory

Learning Outcomes

The students became acquainted with numerical methods for constrained and unconstrained optimization problems. They learn algorithms, results on local and global convergence, and representative applications.

Content

1. General unconstrained minimization methods
2. Newton method
3. Inexact Newton method
4. Quasi Newton method
5. Nonlinear cg iteration
6. Trust region methods
7. Interior point methods
8. Penalty methods
9. Active set strategies
10. SQP methods
11. Non-smooth optimization

Module: Numerical methods in mathematical finance II [MATHNM26]

Coordination: T. Jahnke
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 217)	4/2	W/S	8	T. Jahnke, C. Wieners

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

None.

Learning Outcomes**Content**

Module: Numerical Methods for Integral Equations [MATHNM29]

Coordination: T. Arens
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 213)	4/2	W/S	8	T. Arens

Learning Control / Examinations

Conditions
 None.

Learning Outcomes

Content

Module: Angewandte und Numerische Mathematik [MATHNM30]

Coordination: M. Hochbruck
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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	Angewandte und Numerische Mathematik (p. 111)	4/2	W/S	8	M. Hochbruck

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Module: Geometric numerical integration [MATHNM31]

Coordination: T. Jahnke
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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)
MATHNM31	Geometric numerical integration (p. 168)	2/1	W/S	4	M. Hochbruck, T. Jahnke

Learning Control / Examinations

Conditions
 None.

Learning Outcomes

Content

Module: Mathematical Finance in Discrete Time [MATHST04]

Coordination: N. Bäuerle
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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	Mathematical Finance in Discrete Time (p. 156)	4/2	W	8	N. Bäuerle

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

None.

Recommendations

It is recommended to attend the following modules previously:
 Analysis 3
 Probability Theory

Learning Outcomes**Content**

Module: Statistics [MATHWMST05]

Coordination: B. Klar
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 288)	4/2	W	8	N. Henze, C. Kirch, B. Klar

Learning Control / Examinations

exam: written or oral exam

Marking: grade of exam

Conditions

None.

Recommendations

It is recommended to attend the following modules previously:

Introduction in Stochastics

Learning Outcomes**Content**

Module: Stochastic Geometry [MATHMWST06]

Coordination: D. Hug
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: Stochastics, 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)
MATHST06	Stochastic Geometry (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
 Convex Geometry or Spatial Stochastics

Learning Outcomes

The students

- know the fundamental geometric models in stochastic geometry,
- are familiar with properties of Poisson processes of geometric objects,
- know examples of applications of models of stochastic geometry.

Content

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

Module: Asymptotic Stochastics [MATHMWST07]

Coordination: N. Henze
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 121)	4/2	S	8	N. Henze, C. Kirch, B. Klar

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

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

Learning Outcomes

Students get acquainted with basic concepts and methods of asymptotic stochastics. They gain an overview over the mathematical methods that are used in asymptotic stochastics.

Content

convergence in distribution, characteristic functions and central limit theorem in d dimensions, extreme value distributions, delta method, Glivenko Cantelli theorem, weak convergence in metric spaces, Donsker's theorem, asymptotics of moment and maximum likelihood estimators, asymptotic optimality of estimators, M-estimators, asymptotic confidence regions, likelihood ratio tests

Module: Mathematical Finance in Continuous Time [MATHMWST08]

Coordination: N. Bäuerle
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 157)	4/2	S	8	N. Bäuerle

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grad of exam

Conditions

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

Learning Outcomes

The students
 – have core skills in modern mathematical finance and can apply them,
 – have specific probabilistic techniques,
 – are able to make appropriate mathematical models for economic questions.

Content

martingales in continuous time
 stochastic integrals for continuous semimartingales
 Ito-Doeblin formula
 stochastic differential equations
 theorem of Girsanov
 Black-Scholes modell (no-arbitrage, completeness)
 fundamental theorem of Asset Pricing
 pricing of derivatives: European, American, Exotic Options
 dynamic Portfolio-optimization
 interest rate models

Module: Generalized Regression Models [MATHMWST09]

Coordination: B. Klar
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 164)	2/1	W	4	N. Henze, C. Kirch, B. Klar

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

It is recommended to attend the following modules previously:
 Statistics

Learning Outcomes

Upon completing this module the students know the most important regression models and their properties. They can judge the applicability of these models and interpret the results. They are able to apply the models in the analysis of complex data sets.

Content

Further topics in linear models (design of experiments, model selection), nonlinear models, generalized linear models, mixed models

Module: Brownian Motion [MATHMWST10]

Coordination: N. Bäuerle
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 125)	2/1	W/S	4	N. Bäuerle, N. Henze, C. Kirch, 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

Learning Outcomes

The students

- know properties of the Brownian motion as an example for a stochastic process,
- have specific probabilistic techniques,
- are able to use the Brownian motion as a model for stochastic phenomena.

Content

- path properties of Brownian motion, quadratic variation
- existence
- strong Markov property with applications (reflection principle)
- Donsker's invariance principle

Module: Control theory of stochastic processes [MATHMWST12]

Coordination: N. Bäuerle
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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 theory (p. 294)	2/1	W/S	4	N. Bäuerle

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

It is recommended to attend the following modules previously:
 Probability Theory
 Mathematical Finance in Continuous Time

Learning Outcomes

The students
 – have score skills in modern stochastic control theory and can apply them,
 – have specific probabilistic techniques,
 – are able to model questions as a stochastic control problem.

Content

- verification technique, Hamilton-Jacobi-Bellman equation
- viscosity solution
- singular control
- Feynman-Kac representation

Module: Percolation [MATHMWST13]

Coordination: G. Last
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 230)	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

Learning Outcomes

The students should become acquainted with basic models of discrete and continuum percolation.

Content

- Percolation on graphs
- Harris-Kesten theorem
- Asymptotics of the cluster size in the subcritical and the supercritical case
- Continuum percolation

Module: Spatial Stochastics [MATHMWST14]

Coordination: G. Last
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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)
MATHST14	Spatial Stochastics (p. 244)	4/2	W	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

Learning Outcomes

The students become familiar with some basic spatial stochastic processes. The focus is put not only on general properties of distributions but also on specific models (Poisson process, Gaussian random fields) important for applications.

Content

- Point processes
- Random measures
- Poisson processes
- Ralm distributions
- Spatial ergodic theorem
- Random fields
- Gaussian fields

Module: Mathematical Statistics [MATHMWST15]

Coordination: B. Klar
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 203)	2/1	W/S	4	N. Henze, C. Kirch, B. Klar

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

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

Learning Outcomes

The students become acquainted with fundamental concepts of mathematical statistics; they are capable to apply them to basic problems.

Content

Minimum variance unbiased estimation, BLUE, Cramér-Rao bound, sufficiency, complete statistics, UMP and UMPU tests

Module: Nonparametric statistics [MATHMWST16]

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

ECTS Credits	Cycle	Duration
4	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST16	Nonparametric statistics (p. 212)	2/1	W/S	4	N. Henze, C. Kirch, B. Klar

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

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

Learning Outcomes

Students get acquainted with basic concepts and models of nonparametric statistics. They are able to judge the applicability of these models and know how to apply these models for the analysis of data sets.

Content

Order statistics, empirical distribution function, quantiles, U-statistics, rank statistics, goodness-of-fit tests

Module: Time Series Analysis [MATHMWST18]

Coordination: B. Klar
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 312)	2/1	S	4	N. Henze, C. Kirch, B. Klar

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

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

Learning Outcomes

Students know and understand standard models of time series analysis. Based on examples, they know about model selection and validation procedures. They are capable to apply models as well as methods on real and simulated data sets.

Content

Stationarity, autocorrelation, ARMA models, spectral theory, parameter estimation

Module: Financial Statistics [MATHST19]

Coordination: C. Kirch
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: Stochastics

ECTS Credits	Cycle	Duration
4	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST19	Financial Statistics (p. 158)	2/1	W/S	4	N. Henze, C. Kirch, B. Klar

Learning Control / Examinations

exam:
 written or oral exam
 Marking:
 grade of exam

Conditions

None.

Learning Outcomes**Content**

Module: Poisson processes [MATHST20]

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

ECTS Credits	Cycle	Duration
4	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST20	Poisson processes (p. 136)	2/1	W/S	4	V. Fasen, D. Hug, G. Last

Learning Control / Examinations

Conditions
 None.

Learning Outcomes

Content

Module: Lévy Processes [MATHST21]

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

ECTS Credits	Cycle	Duration
3	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
MATHST21	Lévy Processes (p. 195)	2	W/S	3	V. Fasen, G. Last

Learning Control / Examinations

Conditions
 None.

Learning Outcomes

Content

Module: Seminar [MATHMWSE01]

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

ECTS Credits
3

Cycle
Every term

Duration
1

Learning Control / Examinations

Marking:
no grade

Conditions
None.

Learning Outcomes

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: 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. 137)	2/1	S	4,5	M. Uhrig-Homburg
2530212	Valuation (p. 304)	2/1	W	4,5	M. Ruckes
2530555	Asset Pricing (p. 120)	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 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.

Learning Outcomes

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: 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. 154)	2/1	W	4,5	M. Uhrig-Homburg
2530214	Corporate Financial Policy (p. 132)	2/1	S	4,5	M. Ruckes
2530240	Market Microstructure (p. 202)	2/0	W	3	T. Lüdecke
2530565	Credit Risk (p. 194)	2/1	W	4,5	M. Uhrig-Homburg
2530210	Cost and Management Accounting (p. 187)	2/1	S	4,5	T. Lüdecke
2530555	Asset Pricing (p. 120)	2/1	S	4,5	M. Uhrig-Homburg, M. Ruckes
2530212	Valuation (p. 304)	2/1	W	4,5	M. Ruckes
2530550	Derivatives (p. 137)	2/1	S	4,5	M. Uhrig-Homburg
2530570	International Finance (p. 185)	2	S	3	M. Uhrig-Homburg, Dr. Walter
2530299	Business Strategies of Banks (p. 169)	2	W	3	W. Müller
2530296	Exchanges (p. 124)	1	S	1,5	J. Franke
2530232	Financial Intermediation (p. 155)	3	W	4,5	M. Ruckes
2540454	eFinance: Information Engineering and Management for Securities Trading (p. 143)	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 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

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.

Learning Outcomes

The student has advanced skills in economics and methodology 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

Only in the winter term 2011/2012 the lecture Market Microstructure [2530240] could be replaced by the lecture eFinance: Information Engineering and Management for Securities Trading [2540454] within the corresponding module. Who wanted to replace it in this way had to make the first attempt at passing the examination at the regular examination dates of this winter term 2011/2012. The general regulation concerning the second attempt at passing the examination remains unchanged. The lecture eFinance: Information Engineering and Management for Securities Trading [2540454] must not be chosen in all other cases within this module.

Module: Finance 3 [MATH4BWLFBV11]

Coordination: M. Uhrig-Homburg, M. Ruckes
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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)
2530555	Asset Pricing (p. 120)	2/1	S	4,5	M. Uhrig-Homburg, M. Ruckes
2530212	Valuation (p. 304)	2/1	W	4,5	M. Ruckes
2530550	Derivatives (p. 137)	2/1	S	4,5	M. Uhrig-Homburg
2530260	Fixed Income Securities (p. 154)	2/1	W	4,5	M. Uhrig-Homburg
2530565	Credit Risk (p. 194)	2/1	W	4,5	M. Uhrig-Homburg
2530214	Corporate Financial Policy (p. 132)	2/1	S	4,5	M. Ruckes
2530240	Market Microstructure (p. 202)	2/0	W	3	T. Lüdecke
2530210	Cost and Management Accounting (p. 187)	2/1	S	4,5	T. Lüdecke
2530232	Financial Intermediation (p. 155)	3	W	4,5	M. Ruckes
2530296	Exchanges (p. 124)	1	S	1,5	J. Franke
2530299	Business Strategies of Banks (p. 169)	2	W	3	W. Müller
2530570	International Finance (p. 185)	2	S	3	M. Uhrig-Homburg, Dr. Walter
2540454	eFinance: Information Engineering and Management for Securities Trading (p. 143)	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 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

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.

Learning Outcomes

The student has advanced skills in economics and methodology in the field of 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

Only in the winter term 2011/2012 the lecture Market Microstructure [2530240] could be replaced by the lecture eFinance: Information Engineering and Management for Securities Trading [2540454] within the corresponding module. Who wanted to replace it in this way had to make the first attempt at passing the examination at the regular examination dates of this winter term 2011/2012. The general regulation concerning the second attempt at passing the examination remains unchanged. The lecture eFinance: Information Engineering and Management for Securities Trading [2540454] must not be chosen in all other cases within this module.

Module: Operational Risk Management I [MATHMWBWLFBV9]

Coordination: U. Werner
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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)
2530326	Enterprise Risk Management (p. 149)	3/0	W	4,5	U. Werner
2530328	Multidisciplinary Risk Research (p. 208)	3/0	S	4,5	U. Werner
2530353	International Risk Transfer (p. 184)	2/0	S	2,5	W. Schwehr
2530395	Risk Communication (p. 247)	3/0	W	4,5	U. Werner

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

The module can only be chosen in the following study profile:

- Klassische Wirtschaftsmathematik

At least 50% of the assessment has to be carried out as a general oral exam or a general written exam (not as seminars).

Recommendations

Interest in interdisciplinary research is assumed. Good complements to this module are the engineering science modules *Understanding and Prediction of Disasters I* [WI4INTER1] and *Safety Science I* [WI4INTER4].

Learning Outcomes

See German version.

Content

Operational risk management strategies for different types of risk owners such as private and public households, small and larger business enterprises are introduced. Risks considered may derive from the interaction of human, technical, and organisational factors (internal risks) as well as from external natural, technical, social or political incidents. Aside from classical risk management strategies (risk control and loss financing), self insurance instruments such as captives or risk transfers into reinsurance and capital markets are considered. Additionally, risk communication is studied as a risk management instrument since it seems to become more and more important.

Remarks

The module Operational Risk Management I will not be offered any more.

Students who are already assigned on the module can still finish it until summer term 2013.

The courses *Risk Management of Microfinance and Private Households* [26354] and *Project Work in Risk Research* [2530393] are offered on demand. For further information, see: <http://insurance.fbv.kit.edu>

Module: Operational Risk Management II [MATHMWBWLFBV10]

Coordination: U. Werner
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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)
2530326	Enterprise Risk Management (p. 149)	3/0	W	4,5	U. Werner
2530328	Multidisciplinary Risk Research (p. 208)	3/0	S	4,5	U. Werner
2530353	International Risk Transfer (p. 184)	2/0	S	2,5	W. Schwehr
2530395	Risk Communication (p. 247)	3/0	W	4,5	U. Werner

Learning Control / Examinations

The assessment is carried out as partial exams (according to Section 4(2), 1-3 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

At least 50% of the assessment has to be carried out as a general oral exam or a general written exam (not as seminars).

Recommendations

Interest in interdisciplinary research is assumed. Good complements to this module are the engineering science modules *Understanding and Prediction of Disasters I* [WI4INTER1] and *Safety Science I* [WI4INTER4].

Learning Outcomes

See German version.

Content

See German version.

Remarks

The module Operational Risk Management II will not be offered any more.

Students who are already assigned on the module can still finish it until summer term 2013.

The courses *Insurance Production* [2530324], and *Service Management* [26327] are offered on demand, according to the students' wishes. For further information, see: <http://insurance.fbv.kit.edu>

Module: Insurance Management I [MATHMWBWLFBV6]

Coordination: U. Werner
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 239)	3/0	S	4,5	U. Werner
2530323	Insurance Marketing (p. 177)	3/0	S	4,5	E. Schwake
2530320	Insurance Accounting (p. 176)	3/0	W	4,5	E. Schwake
2530324	Insurance Production (p. 178)	3/0	W/S	4,5	U. Werner
2530050	Private and Social Insurance (p. 240)	2/0	W	2,5	W. Heilmann, K. Besserer
2530350	Current Issues in the Insurance Industry (p. 133)	2/0	S	2,5	W. Heilmann
2530335	Insurance Risk Management (p. 179)	2/0	S	2,5	H. Maser
INSGAME	P+C Insurance Game (p. 228)	3	W	3	U. Werner
2530353	International Risk Transfer (p. 184)	2/0	S	2,5	W. Schwehr
2530395	Risk Communication (p. 247)	3/0	W	4,5	U. Werner
2530355	Modelling, Measuring and Managing of Extreme Risks (p. 207)	2	S	2.5/3	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.

Learning Outcomes

See German version.

Content

See German version.

Remarks

The courses *Insurance Production* [2530324], and *Service Management* [26327] are offered on demand, according to the students' wishes. For further information, see: <http://insurance.fbv.kit.edu>

Module: Energy Economics and Technology [MATHMWBWLIP5]

Coordination: W. Fichtner
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 146)	2/1	S	4,5	U. Karl, n.n.
2581958	Strategical Aspects of Energy Economy (p. 296)	2/0	W	3,5	A. Ardone
2581000	Technological Change in Energy Eco- nomics (p. 301)	2/0	W	3	M. Wietschel
2581001	Heat Economy (p. 307)	2/0	S	3	W. Fichtner
2581002	Energy Systems Analysis (p. 147)	2/0	W	3	V. Bertsch
2581006	Efficient Energy Systems and Electric Mobility (p. 141)	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 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. Additional courses might be accredited upon request.

Conditions

None.

Learning Outcomes**Content**

Module: Strategic Corporate Management and Organization [MATHMWUO1]

Coordination: H. Lindstädt
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 227)	2	W	4,5	H. Lindstädt
2577902	Managing Organizations (p. 226)	2/0	W	4	H. Lindstädt
2577908	Modeling Strategic Decision Making (p. 205)	2	S	4,5	H. Lindstädt
2577900	Management and Strategy (p. 303)	2/0	S	4	H. Lindstädt
2577907	Special Topics in Management: Management and IT (p. 283)	1/0	W/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 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.

Learning Outcomes**Content**

Module: Marketing Management [MATHMWBWLMAR5]

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

ECTS Credits	Cycle	Duration
9	Every term	

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2571154	Product and Innovation Marketing (p. 241)	2/0	S	3	M. Klarmann
2571150	Market Research (p. 201)	2/1	S	4,5	M. Klarmann
2572167	Behavioral Approaches in Marketing (p. 306)	2/1	W	4,5	B. Neibecker
2571165	Strategic and Innovative Decision Making in Marketing (p. 297)	2/1	S	4,5	B. Neibecker
2572155	International Marketing (p. 183)	1	W	1,5	M. Klarmann
2572184	Business Plan Workshop (p. 126)	1	W	3	M. Klarmann, O. Terzidis
2571176	Marketing Strategy Business Game (p. 200)	1	S	1,5	M. Klarmann, Mitarbeiter
2571185	Strategic Brand Management (p. 295)	1/0	S	1,5	M. Klarmann, J. Blickhäuser

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.

Learning Outcomes**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
- "International Marketing"
- "Strategic and Behavioral Marketing"
- "Strategic and Innovative Decision Making in Marketing"
- "Business Plan Workshop"
- "Marketing and Strategy Business Game"

Remarks

For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).

Module: Decision and Game Theory [MATHMWVWL10]

Coordination: C. Puppe
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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)
2520525	Game Theory I (p. 285)	2/2	S	4,5	P. Reiss
2520365	Decision Theory (p. 150)	2/1	S	4,5	K. Ehrhart
2590408	Auction Theory (p. 122)	2/1	W	4,5	K. Ehrhart
2540489	Experimental Economics (p. 153)	2/1	W	4,5	M. Adam, 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 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.

Learning Outcomes**Content**

Module: Innovation and growth [MATHMWVWLIWW1]

Coordination: I. Ott
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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)
2520543	Theory of Economic Growth (p. 302)	2/1	S	4,5	M. Hillebrand
2560236	Innovationtheory and -policy (p. 175)	2/1	S	5	I. Ott
2561503	Theory of endogenous growth (p. 145)	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 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

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

- 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: Growth and Agglomeration [MATHMWVWL12]

Coordination: I. Ott
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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)
2561503	Theory of endogenous growth (p. 145)	2/1	W	4,5	I. Ott
2561260 / 2561261	Spatial Economics (p. 274)	2/1	W	4,5	I. Ott
2560254	International Economic Policy (p. 186)	2/1	S	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.

Learning Outcomes

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: Mathematical and Empirical Finance [MATHMWSTAT1]

Coordination: Y. Kim
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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)
2520357	Portfolio and Asset Liability Management (p. 231)	2/1	S	5	Y. Kim
2521331	Stochastic Calculus and Finance (p. 289)	2/1	W	5	Y. Kim

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 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.

Learning Outcomes**Content**

Module: Applications of Operations Research [MATHMWOR5]

Coordination: S. Nickel
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 287)	2/1	W	4,5	S. Nickel
2550488	Tactical and Operational Supply Chain Management (p. 300)	2/1	S	4,5	S. Nickel
2550490	Software Laboratory: OR Models I (p. 271)	1/2	S	4,5	S. Nickel
2550134	Global Optimization I (p. 170)	2/1	W	4,5	O. Stein
2550662	Simulation I (p. 269)	2/1/2	W	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 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 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.

Learning Outcomes

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 Supply 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: 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. 210)	2/1	S	4,5	O. Stein
2550113	Nonlinear Optimization II (p. 211)	2/1	S	4,5	O. Stein
2550134	Global Optimization I (p. 170)	2/1	W	4,5	O. Stein
2550136	Global Optimization II (p. 171)	2/1	W	4,5	O. Stein
2550486	Facility Location and Strategic Supply Chain Management (p. 287)	2/1	W	4,5	S. Nickel
2550679	Markov Decision Models I (p. 291)	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 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

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

Learning Outcomes

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: 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. 291)	2/1/2	W	5	K. Waldmann
2550682	Markov Decision Models II (p. 292)	2/1/2	S	4,5	K. Waldmann
2550662	Simulation I (p. 269)	2/1/2	W	4,5	K. Waldmann
2550665	Simulation II (p. 270)	2/1/2	S	4,5	K. Waldmann
2550111	Nonlinear Optimization I (p. 210)	2/1	S	4,5	O. Stein
2550488	Tactical and Operational Supply Chain Management (p. 300)	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 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.

Learning Outcomes

The student knows and understands stochastic relationships and has a competent knowledge in modelling, analyzing and optimizing stochastic systems in economics and engineering.

Content

Topics overview:

Stochastic Decision Models I: Markov Chains, Poisson 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 three 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: 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. 287)	2/1	W	4,5	S. Nickel
2550488	Tactical and Operational Supply Chain Management (p. 300)	2/1	S	4,5	S. Nickel
2550480	Operations Research in Supply Chain Management (p. 220)	2/1	W/S	4,5	S. Nickel
2550495	Operations Research in Health Care Management (p. 219)	2/1	W/S	4,5	S. Nickel
2550493	Hospital Management (p. 193)	2/0	W/S	3	S. Nickel, Hansis
2550498	Practical seminar: Health Care Management (with Case Studies) (p. 238)	2/1/2	W/S	7	S. Nickel
2550497	Software Laboratory: OR Models II (p. 272)	2/1	W	4,5	S. Nickel
n.n.	Discrete-event Simulation in Production and Logistics (p. 151)	2/1	S	4,5	S. Nickel, S. Spieckermann

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 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 module can be chosen in the following profiles:

- Operations Research
- Classical business mathematics

Recommendations

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

Learning Outcomes

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 Supply 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.

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: 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. 161)	2/1	S	4,5	O. Stein
25140	Mixed Integer Programming II (p. 162)	2/1	W	4,5	O. Stein
2550128	Special Topics in Optimization I (p. 281)	2/1	W/S	4,5	O. Stein
2550126	Special Topics in Optimization II (p. 282)	2/1	W/S	4,5	O. Stein
2550484	Graph Theory and Advanced Location Models (p. 172)	2/1	W/S	4,5	S. Nickel
2550497	Software Laboratory: OR Models II (p. 272)	2/1	W	4,5	S. Nickel
2550111	Nonlinear Optimization I (p. 210)	2/1	S	4,5	O. Stein
2550113	Nonlinear Optimization II (p. 211)	2/1	S	4,5	O. Stein
2550134	Global Optimization I (p. 170)	2/1	W	4,5	O. Stein
2550136	Global Optimization II (p. 171)	2/1	W	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 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

Upon consultation with the module coordinator, alternatively one lecture from the modules *Operations Research in Supply Chain Management and Health Care Management* [WW4OR5] and *Stochastic Modeling and Optimization* [WW4OR7] or one of the lectures *Game Theory I* [2520525] and *Game Theory II* [2521369] may be accepted.

Learning Outcomes

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 make 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: 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. 291)	2/1/2	W	5	K. Waldmann
2550682	Markov Decision Models II (p. 292)	2/1/2	S	4,5	K. Waldmann
2550674	Quality Control I (p. 242)	2/1/2	W	4,5	K. Waldmann
25659	Quality Control II (p. 243)	2/1/2	S	4,5	K. Waldmann
25687	Optimization in a Random Environment (p. 221)	2/1/2	W/S	4,5	K. Waldmann
2550662	Simulation I (p. 269)	2/1/2	W	4,5	K. Waldmann
2550665	Simulation II (p. 270)	2/1/2	S	4,5	K. Waldmann
25688	OR-oriented modeling and analysis of real problems (project) (p. 223)	1/0/3	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 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.

Learning Outcomes

The student knows and understands stochastic relationships and has a competent knowledge in modelling, analyzing and optimizing stochastic systems in economics and engineering.

Content

see courses

Module: Informatics [MATHMWINFO1]

Coordination: H. Schmeck, A. Oberweis, D. Seese, R. Studer, S. Tai
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 116)	2/1	W	5	H. Schmeck
2511030	Applied Informatics I - Modelling (p. 118)	2/1	W	4	A. Oberweis, R. Studer, S. Agarwal
2511032	Applied Informatics II - IT Systems for e-Commerce (p. 119)	2/1	S	4	S. Tai
2511400	Complexity Management (p. 128)	2/1	S	5	D. Seese
2511200	Database Systems (p. 134)	2/1	S	5	A. Oberweis, Dr. D. Sommer
2511500	Service Oriented Computing 1 (p. 267)	2/1	W	5	S. Tai
2511300	Knowledge Management (p. 310)	2/1	W	5	R. Studer
2511504	Cloud Computing (p. 127)	2/1	W	5	S. Tai, Kunze
2511202	Database Systems and XML (p. 135)	2/1	W	5	A. Oberweis
2511212	Document Management and Groupware Systems (p. 140)	2	S	4	S. Klink
2511100	Efficient Algorithms (p. 142)	2/1	S	5	H. Schmeck
2511600	Enterprise Architecture Management (p. 148)	2/1	W	5	T. Wolf
2511402	Intelligent Systems in Finance (p. 181)	2/1	S	5	D. Seese
2511404	IT Complexity in Practice (p. 199)	2/1	W	5	D. Seese, Kreidler
2511302	Knowledge Discovery (p. 190)	2/1	W	5	R. Studer
2511214	Management of IT-Projects (p. 198)	2/1	S	5	R. Schätzle
2511210	Business Process Modelling (p. 206)	2/1	W	5	A. Oberweis
2511106	Nature-inspired Optimisation Methods (p. 209)	2/1	W	5	S. Mostaghim, P. Shukla
2511104	Organic Computing (p. 224)	2/1	S	5	H. Schmeck, S. Mostaghim
2590458	Computational Economics (p. 130)	2/1	W	4,5	P. Shukla, S. Caton
2511216	Capability maturity models for software and systems engineering (p. 246)	2	S	4	R. Kneuper
2511304	Semantic Web Technologies I (p. 248)	2/1	W	5	R. Studer, S. Rudolph, E. Simperl
2511306	Semantic Web Technologies II (p. 249)	2/1	S	5	E. Simperl, A. Harth, S. Rudolph, Daniel Oberle
2511308	Service Oriented Computing 2 (p. 268)	2/1	S	5	R. Studer, S. Agarwal, B. Norton
2511208	Software Technology: Quality Management (p. 273)	2/1	S	5	A. Oberweis
25700sp	Special Topics of Efficient Algorithms (p. 277)	2/1	W/S	5	H. Schmeck
SBI	Special Topics of Enterprise Information Systems (p. 276)	2/1	W/S	5	A. Oberweis
KompMansp	Special Topics of Complexity Management (p. 278)	2/1	W/S	5	D. Seese
SSEsp	Special Topics of Software- and Systemsengineering (p. 279)	2/1	W/S	5	A. Oberweis, D. Seese
25860sem	Special Topics of Knowledge Management (p. 280)	2/1	W/S	5	R. Studer
2511602	Strategic Management of Information Technology (p. 298)	2/1	S	5	T. Wolf
2511204	Workflow-Management (p. 311)	2/1	S	5	A. Oberweis
25810	Practical Seminar Knowledge Discovery (p. 266)	2	S	4	R. Studer

PraBl	Computing Lab Information Systems (p. 232)	2	W/S	5	A. Oberweis, D. Seese, R. Studer
25700p	Advanced Lab in Efficient Algorithms (p. 233)	3	W/S	4	H. Schmeck
25762p	Computing Lab in Intelligent Systems in Finance (p. 234)	3	W/S	4	D. Seese
25818	Computing Lab in Complexity Management (p. 235)	3	W/S	4	D. Seese
25820	Lab Class Web Services (p. 236)	2	W	4	S. Tai
25740p	Exercises in Knowledge Management (p. 237)	3	W/S	4	R. Studer
2511218	Requirements Analysis and Requirements Management (p. 117)	2/0	W	4	R. Kneuper

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

One course has to be chosen from the core courses.

Core courses are: *Algorithms for Internet Applications* [2511102], *Applied Informatics I - Modelling* [2511030], *Applied Informatics II - IT Systems for e-Commerce* [2511032], *Complexity Management* [2511400], *Database Systems* [2511200], *Service-oriented Computing I* [2511500] and *Knowledge Management* [2511300].

It is only allowed to choose one lab.

Learning Outcomes

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 und Software- und Systems Engineering.

Remarks

The course "Web Service Engineering" will not be offered any more from summer term 2012 on. The examination will be offered latest until summer term 2013 (repeaters only).

Module: Emphasis in Informatics [MATHMWINFO2]

Coordination: H. Schmeck, A. Oberweis, D. Seese, R. Studer, S. Tai
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 116)	2/1	W	5	H. Schmeck
2511030	Applied Informatics I - Modelling (p. 118)	2/1	W	4	A. Oberweis, R. Studer, S. Agarwal
2511032	Applied Informatics II - IT Systems for e-Commerce (p. 119)	2/1	S	4	S. Tai
2511400	Complexity Management (p. 128)	2/1	S	5	D. Seese
2511200	Database Systems (p. 134)	2/1	S	5	A. Oberweis, Dr. D. Sommer
2511500	Service Oriented Computing 1 (p. 267)	2/1	W	5	S. Tai
2511300	Knowledge Management (p. 310)	2/1	W	5	R. Studer
2511202	Database Systems and XML (p. 135)	2/1	W	5	A. Oberweis
2511212	Document Management and Groupware Systems (p. 140)	2	S	4	S. Klink
2511100	Efficient Algorithms (p. 142)	2/1	S	5	H. Schmeck
2511600	Enterprise Architecture Management (p. 148)	2/1	W	5	T. Wolf
2511402	Intelligent Systems in Finance (p. 181)	2/1	S	5	D. Seese
2511404	IT Complexity in Practice (p. 199)	2/1	W	5	D. Seese, Kreidler
2511302	Knowledge Discovery (p. 190)	2/1	W	5	R. Studer
2511214	Management of IT-Projects (p. 198)	2/1	S	5	R. Schätzle
2511210	Business Process Modelling (p. 206)	2/1	W	5	A. Oberweis
2511106	Nature-inspired Optimisation Methods (p. 209)	2/1	W	5	S. Mostaghim, P. Shukla
2511104	Organic Computing (p. 224)	2/1	S	5	H. Schmeck, S. Mostaghim
2590458	Computational Economics (p. 130)	2/1	W	4,5	P. Shukla, S. Caton
2511216	Capability maturity models for software and systems engineering (p. 246)	2	S	4	R. Kneuper
2511304	Semantic Web Technologies I (p. 248)	2/1	W	5	R. Studer, S. Rudolph, E. Simperl
2511306	Semantic Web Technologies II (p. 249)	2/1	S	5	E. Simperl, A. Harth, S. Rudolph, Daniel Oberle
2511308	Service Oriented Computing 2 (p. 268)	2/1	S	5	R. Studer, S. Agarwal, B. Norton
2511208	Software Technology: Quality Management (p. 273)	2/1	S	5	A. Oberweis
SBI	Special Topics of Enterprise Information Systems (p. 276)	2/1	W/S	5	A. Oberweis
25700sp	Special Topics of Efficient Algorithms (p. 277)	2/1	W/S	5	H. Schmeck
KompMansp	Special Topics of Complexity Management (p. 278)	2/1	W/S	5	D. Seese
SSEsp	Special Topics of Software- and Systemsengineering (p. 279)	2/1	W/S	5	A. Oberweis, D. Seese
25860sem	Special Topics of Knowledge Management (p. 280)	2/1	W/S	5	R. Studer
2511602	Strategic Management of Information Technology (p. 298)	2/1	S	5	T. Wolf
2511204	Workflow-Management (p. 311)	2/1	S	5	A. Oberweis
PraBI	Computing Lab Information Systems (p. 232)	2	W/S	5	A. Oberweis, D. Seese, R. Studer

25700p	Advanced Lab in Efficient Algorithms (p. 233)	3	W/S	4	H. Schmeck
25762p	Computing Lab in Intelligent Systems in Finance (p. 234)	3	W/S	4	D. Seese
25818	Computing Lab in Complexity Management (p. 235)	3	W/S	4	D. Seese
25810	Practical Seminar Knowledge Discovery (p. 266)	2	S	4	R. Studer
25820	Lab Class Web Services (p. 236)	2	W	4	S. Tai
25740p	Exercises in Knowledge Management (p. 237)	3	W/S	4	R. Studer
2511504	Cloud Computing (p. 127)	2/1	W	5	S. Tai, Kunze
2511218	Requirements Analysis and Requirements Management (p. 117)	2/0	W	4	R. Kneuper

Learning Control / Examinations

The assessment is carried out as two 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 seperately.

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

The module *Informatics* [MATHMWINFO1] has to be completed successfully.

Learning Outcomes

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 und Software- und Systems Engineering.

Remarks

The course "Web Service Engineering" will not be offered any more from summer term 2012 on. The examination will be offered latest until summer term 2013 (repeaters only).

Module: Seminar [MATHMWSEM02]

Coordination: O. Stein
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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)
2530293	Seminar in Finance (p. 253)	2	W/S	3	M. Uhrig-Homburg, M. Ruckes
SemFBV1	Seminar in Insurance Management (p. 259)	2	W/S	3	U. Werner
SemFBV2	Seminar in Operational Risk Management (p. 260)	2	W/S	3	U. Werner
2577915	Seminar: Management and Organization (p. 265)	2	W/S	3	H. Lindstädt
SemWIOR3	Seminar in Experimental Economics (p. 262)	2	W/S	3	N. N.
SemWIOR2	Seminar Economic Theory (p. 309)	2	W/S	3	C. Puppe
SemIWW3	(p. 254)	2	W/S	3	I. Ott
SemETS3	Seminar on Macroeconomic Theory (p. 264)	2		3	M. Hillebrand

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Module: Seminar [MATHMWSEM03]

Coordination: O. Stein
Degree programme: Wirtschaftsmathematik (M.Sc.)
Subject: 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. 250)	2	W/S	4	R. Studer, A. Oberweis, T. Wolf, R. Kneuper
SemAIFB2	Seminar Efficient Algorithms (p. 251)	2	W/S	3	H. Schmeck
SemAIFB3	Seminar Complexity Management (p. 255)	2	W/S	3	D. Seese
SemAIFB4	Seminar Knowledge Management (p. 258)	2	W	4	R. Studer
SemAIFB5	Seminar eOrganization (p. 252)	2	S	3	S. Tai
2595470	Seminar Service Science, Management & Engineering (p. 256)	2	W/S	4	C. Weinhardt, R. Studer, S. Nickel, H. Fromm, W. Fichtner
2550131	Seminar in Continuous Optimization (p. 263)	2	W/S	3	O. Stein
2550491	Seminar in Discrete Optimization (p. 261)	2	W/S	3	S. Nickel
SemWIOR1	Seminar Stochastic Models (p. 257)	2	W/S	3	K. Waldmann

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

4.3 Module in Key Competences

Module: [MATHWMSQ01]

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

ECTS Credits	Cycle	Duration
3-4		

Learning Control / Examinations

Conditions
None.

Learning Outcomes**Content**

5 Courses

5.1 All Courses

Course: Angewandte und Numerische Mathematik [MATHNM30]

Coordinators: M. Hochbruck

Part of the modules: Angewandte und Numerische Mathematik (p. [64](#))[MATHNM30]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	Winter / 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. [36](#))[MATHAG28]

ECTS Credits	Hours per week	Term	Instruction language
7	3/2	Winter / Summer Term	

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

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.

Recommendations

It is recommended to attend the following modules previously:

Linear Algebra 1+2

Analysis 1+2

Introduction into Algebra and Number Theory

Learning Outcomes

- Concepts and methods of algebra
- Preparation to seminars and further courses in algebraic geometry and number theory

Content

- Fields:
field extensions, Galois theory, cyclotomic fields
- Valuations:
valuation rings, extension of values, local fields
- Dedekind domains:
integral ring extensions, normal closure, noetherian rings

Course: Algebraic Geometry [MATHAG10]**Coordinators:** F. Herrlich, S. Kühnlein**Part of the modules:** Algebraic Geometry (p. [29](#))[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 Number Theory [MATHAG09]**Coordinators:** S. Kühnlein, C. Schmidt**Part of the modules:** Algebraic Number Theory (p. [28](#))[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. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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

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. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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

Literature

Literature will be given in the lecture.

Course: Applied Informatics I - Modelling [2511030]**Coordinators:** A. Oberweis, R. Studer, S. Agarwal**Part of the modules:** Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes

Basic knowledge about the strengths and weaknesses of various modeling approaches including their application areas.

Content

In the context of complex information systems, modelling is of central importance, e.g. – in the context of systems to be developed – for a better understanding of their functionality or in the context of existing systems for supporting maintenance and further development.

Modelling, in particular modelling of information systems, forms the core part of this lecture. The lecture is organized in two parts. The first part mainly covers the modelling of static aspects, the second part covers the modelling of dynamic aspects of information systems.

The lecture sets out with a definition of modelling and the advantages of modelling. After that, advanced aspects of UML, the Entity Relationship model (ER model) and description logics as a means of modelling static aspects will be explained. This will be complemented by the relational data model and the systematic design of databases based on ER models. For modelling dynamic aspects, different types of petri-nets as well as event driven process chains together with their respective analysis techniques will be introduced.

Media

Slides.

Literature

- Bernhard Rumpe. Modellierung mit UML, Springer-Verlag, 2004.
- R. Elmasri, S. B. Navathe. Fundamentals of Database Systems. Pearson Education, 4. Aufl., 2004, ISBN 0321204484.
- W. Reisig. Petri-Netze, Springer-Verlag, 1986.

Elective literature:

- Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, York Sure: Semantic Web - Grundlagen, Springer, 2008 (ISBN 978-3-540-33993-9)
- Staab, Studer: Handbook on Ontologies, Springer, 2003
- J.L. Peterson: Petri Net Theory and Modeling of Systems, Prentice Hall, 1981.
- Franz Baader, Diego Calvanese, Deborah McGuinness, Daniele Nardi, Peter Patel-Schneider. The Description Logic Handbook - Theory, Implementation and Applications, Cambridge 2003.

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

Coordinators: S. Tai

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	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 IT methods and systems in support of modern electronic commerce. The student should be able to select, assess, design, and apply these methods and systems in a context-sensitive manner.

Content

The course introduces methods and systems in support of electronic commerce, including the topics:

- application architectures (incl. client server architectures)
- document description and exchange (incl. XML)
- enterprise middleware (incl. CORBA, Messaging Middleware, Java Enterprise Edition)
- Web services and SOA

Media

Slides, internet resources.

Literature

Tba in the lecture.

Course: Asset Pricing [2530555]**Coordinators:** M. Uhrig-Homburg, M. Ruckes**Part of the modules:** Finance 1 (p. 83)[MATHMWBWLFVB1], Finance 3 (p. 85)[MATH4BWLFVB11], Finance 2 (p. 84)[MATHMWBWLFVB2]

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

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

The objective of this course is to become familiar with advanced concepts in asset pricing (in particular the stochastic discount factor model). The second half of the course will put a focus on empirical questions related to the previous part. We strongly recommend knowledge of the basic topics in investments (bachelor course), which will be necessary to be able to follow the course.

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.

Literature**Basic literature**

- Asset pricing / Cochrane, J.H. - Rev. ed., Princeton Univ. Press, 2005.
- The econometrics of financial markets / Campbell, J.Y., Lo, A.W., MacKinlay, A.C. - 2. printing, with corrections, Princeton Univ. Press, 1997.

Elective literature

- Investments and Portfolio Management / Bodie, Z., Kane, A., Marcus, A.J. - 9. ed., McGraw-Hill, 2011.

Course: Asymptotic Stochastics [MATHST07]**Coordinators:** N. Henze, C. Kirch, B. Klar**Part of the modules:** Asymptotic Stochastics (p. [69](#))[MATHMWST07]**ECTS Credits**
8**Hours per week**
4/2**Term**
Summer term**Instruction language****Learning Control / Examinations****Conditions**

None.

Learning Outcomes**Content**

Course: Auction Theory [2590408]**Coordinators:** K. Ehrhart**Part of the modules:** Decision and Game Theory (p. 92)[MATHMWVWL10]

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.

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. [58](#))[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. 85)[MATH4BWLFBV11], Finance 2 (p. 84)[MATHMWBWLFBV2]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes

Students learn about current developments regarding organisation of exchanges and securities trading.

Content

- Organisation of exchanges: Changing Zeitgeist - Corporates instead of cooperative 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?

Literature**Elective literature:**

Educational material will be offered within the lecture.

Course: Brownian Motion [MATHST10]

Coordinators: N. Bäuerle, N. Henze, C. Kirch, G. Last
Part of the modules: Brownian Motion (p. [72](#))[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. [91](#))[MATHMWBWLMAR5]

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

Learning Control / Examinations

See German version.

Conditions

None.

Learning Outcomes**Content**

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

RemarksFor further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).

Course: Cloud Computing [2511504]**Coordinators:** S. Tai, Kunze**Part of the modules:** Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes

The course introduces concepts, methods, and techniques of Cloud Computing for providing and consuming IT resources, development- and runtime environments, and software applications of all kinds as Web services.

Content

Building on compute and storage virtualization, Web (service) technology, and distributed systems, Cloud Computing provides scalable, network-centric, abstracted IT infrastructure, platforms, and software applications as on-demand services that are billed by consumption. Innovative business models and cost efficiency are associated with Cloud Computing. The lecture introduces Cloud Computing, covering topics such as:

- Fundamentals: Virtualization, Service-orientation
- Cloud services: IaaS, PaaS, SaaS
- Cloud storage, distributed systems architecture
- Cloud service engineering, programming models
- Cloud service quality

Literature

Cloud Computing: Web-Based Dynamic IT Services, von C. Baun, M. Kunze, J. Nimis, S. Tai. Springer-Verlag 2011.

Course: Complexity Management [2511400]

Coordinators: D. Seese

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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). The exam will be offered every semester and may be repeated at every ordinary exam date.

Questions are in German and English, answers are possible in German or in English.

In case that only a small number of candidates apply for the examination there will be offered an oral examination according to Section 4(2),1 of the examination regulation.

Conditions

None.

Recommendations

A basic knowledge in informatics is suitable.

Learning Outcomes

Students will be enabled to acquire abilities, methods and instruments in the area of complexity management and learn to use them in an innovative way. The students should be enabled to find arguments for the solution of problems in this area. The basic goal of the lecture is to enable to understand the difficulties to manage complex systems and processes.

Content

Complexity is one of the biggest challenges of our time. Central questions are: - Why humans often fail in complex situations? - What is complexity? - What are reasons for complexity? - Which parameters are essential to control complexity? - How systems have to be designed to reduce their complexity and to enable management of complexity?

The lecture gives a survey on fundamental results and handles the following topics: - Understanding of the difficulties produced by complex systems and complex processes - Foundations: modelling complex systems, complexity theory, descriptive, structural and parametric complexity, dynamic systems, topology, dimension, non-linearity, chaos, randomness and emerging structures, human shortcomings, simulation - Complexity of products and production - Complexity of markets - How to improve complexity management? - Decision support by intelligent use of IT

Media

The slides of the lectures will be provided on the website of the lecture.

Literature

- Franz Reither: Komplexitätsmanagement. Gerling Akademie Verlag, München 1997
- Dietrich Dörner: The Logic of Failure, Basic Books 1996
- G. Schuh, U. Schwenk: Produktkomplexität managen. Carl Hanser Verlag, München 2001
- Ch. Perrow: Normal Accidents. Living with High-Risk technologies, Basic Books, New York, 1984.
- J.D. Sterman: Business Dynamics, Systems Thinking and Modeling for a Complex World, McGraw-Hill Higher Education, 2000.
- R. G. Downey, M.R. Fellows: Parameterized Complexity. Springer 1999
- Heinz-Otto Peitgen, Hartmut Jürgens, Dietmar Saupe: Chaos and Fractals, Springer-Verlag New York, 1992, 2004 (second edition).
- S. Wolfram: A new kind of Science. Wolfram Media Inc. 2002

Elective literature:

- M.R. Garey, D. S. Johnson: Computers and intractability A guide to the theory of NP-completeness, W. H. Freeman and Company, New York, 1979
- N. Immerman: Descriptive Complexity; Springer-Verlag, New York 1999
- R. Diestel: Graphentheorie, Springer 1996
- J. A. Bondy, U.S.R. Murty: Graph Theory, Springer 2008
- H.D. Ebbinghaus, J. Flum, W. Thomas: Mathematical Logic, Springer-Verlag, New York 1984
- Christos H. Papadimitriou: Computational Complexity, Addison-Wesley, Reading, Massachusetts, 1994
- R. Niedermeier: Invitation to Fixed-Parameter Algorithms, Oxford University Press 2006

- W. Metzler: Nichtlineare Dynamik und Chaos, Teubner Studienbücher Mathematik, Stuttgart 1998
- G. Frizelle, H. Richards (eds.): Tackling industrial complexity: the ideas that make a difference. University of Cambridge, Institute of Manufacturing 2002
- W. Bick, S. Drexel-Wittbecker: Komplexität reduzieren, Konzept. Methoden. Praxis, LOG_X Verlag GmbH, Stuttgart, 2008
- U. Lindemann, M. Maurer, T. Braun: Structural Complexity Management, An Approach for the field of Product Design, Springer-Verlag, Berlin, Heidelberg, 2009
- M. J. North, Ch. M. Macal: Managing Business Complexity, Discovering Strategic Solutions with Agent-Based Modeling and Simulation, Oxford University Press 2006
- S. Bornholdt, H. G. Schuster (Eds.): Handbook of Graphs and Networks, From the Genome to the Internet, Wiley-VCH, 2003
- Further references will be given in each lecture.

Remarks

The content of the lecture will permanently be adapted to actual developments. This can be the cause to changes of the described content and schedule.

The course "Complexity Management" will not be offered any more from summer term 2016 on. The examination will be offered latest until summer term 2015 (repeaters only).

Course: Computational Economics [2590458]

Coordinators: P. Shukla, S. Caton

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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

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. [42](#))[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. 84)[MATHMWBWLFVB2], Finance 3 (p. 85)[MATH4BWLFVB11]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes

Students are told profound knowledge about appropriate financing of firms.

Content

The course deals with the theory of corporate finance:

- Financing contracts
- Financing capacity
- Issuance of securities
- Capital structure
- Payout policy
- Liquidity management
- Corporate acquisitions and restructurings

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. 88)[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 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.

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 Böhner, N. Lebensversicherung von A-Z. Verlag Versicherungswirtschaft. 1999
 Fürstenwerth, J., and Weiß, 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 secretary of the chair: thomas.mueller3@kit.edu.

Course: Database Systems [2511200]

Coordinators: A. Oberweis, Dr. D. Sommer

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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 in the first week after lecture period.

Conditions

Knowledge of course *Applied Informatics I - Modelling* [2511030] is expected.

Learning Outcomes

Students

- are familiar with the concepts and principles of data base models, languages and systems and their applications,
- can design and model relational data bases on the basis of theoretical foundations,
- are able to ensure an error-free operation and the integrity of the data base and
- know how to handle enhanced data base problems occurring in the enterprises.

Content

Database systems (DBS) play an important role in today's companies. Internal and external data is stored and processed in databases in every company. The proper management and organization of data helps to solve many problems, enables simultaneous queries from multiple users and is the organizational and operational base for the entire working procedures and processes of the company. The lecture leads in the area of the database theory, covers the basics of database languages and database systems, considers basic concepts of object-oriented and XML databases, conveys the principles of multi-user control of databases and physical data organization. In addition, it gives an overview of business problems often encountered in practice such as:

- Correctness of data (operational, semantic integrity)
- Restore of a consistent database state
- Synchronization of parallel transactions (phantom problem).

Media

Slides, Access to internet resources

Literature

Elective literature:

- Schlageter, Stucky. Datenbanksysteme: Konzepte und Modelle. Teubner 1983.
- S. M. Lang, P. C. Lockemann. Datenbankeinsatz. Springer-Verlag 1995.
- Jim Gray, Andreas Reuter. Transaction Processing: Concepts and Techniques. Morgan Kaufmann 1993.

Further literature will be given individually.

Course: Database Systems and XML [2511202]

Coordinators: A. Oberweis

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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, as well as appropriate data models and are capable of generating XML documents. They are able to use XML database systems and to formulate queries to XML documents. Furthermore, they 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 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.

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. 2002
- G. Vossen: Datenbankmodelle, Datenbanksprachen und Datenbankmanagementsysteme. Oldenbourg 2000

Course: Poisson processes [MATHST20]**Coordinators:** V. Fasen, D. Hug, G. Last**Part of the modules:** Poisson processes (p. [80](#))[MATHST20]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Course: Derivatives [2530550]**Coordinators:** M. Uhrig-Homburg**Part of the modules:** Finance 2 (p. 84)[MATHMWBWLFVB2], Finance 3 (p. 85)[MATH4BWLFVB11], Finance 1 (p. 83)[MATHMWBWLFVB1]

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

Literature

- Hull (2005): Options, Futures, & Other Derivatives, Prentice Hall, 6th Edition

Elective literature:

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

Course: Differential Geometry [1036]**Coordinators:** O. Baues, S. Grensing, T. Lamm, 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.

Recommendations

It is recommended to attend the following modules previously:

Linear Algebra 1+2

Analysis 1+2

Introduction into Geometry and Topology

Learning Outcomes

Introduction to the concepts of Differential Geometry

Content

- manifolds
- Riemannian metrics
- connections
- geodesics
- curvature
- length metrics
- curvature and topology

Course: Discrete Geometry [1535]**Coordinators:** D. Hug**Part of the modules:** Discrete Geometry (p. [25](#))[MATHMWAG06]

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

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+2

Learning Outcomes

The students

- know fundamental combinatorial properties and results about convex polytopes, geometric graphs and packings,
- understand metric, combinatorial and graph theoretic arguments and apply these in modified form.

Content

- Combinatorial Properties of Convex Sets
- Convex Polytopes
- Geometric Graphs
- Algorithmic Problems
- Packing and Covering
- Lattices

Course: Document Management and Groupware Systems [2511212]

Coordinators: S. Klink

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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.

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. 89)[MATHMWBWLIP5]

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.

Literature

Will be announced in the lecture.

Course: Efficient Algorithms [2511100]**Coordinators:** H. Schmeck**Part of the modules:** Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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 resources
- lecture recording (camtasia)

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 3 (p. 85)[MATH4BWLFBV11], Finance 2 (p. 84)[MATHMWBWLFBV2]

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 practical aspects of securities 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 platforms,
- 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

Literature

- Picot, Arnold, Christine Bortenlänger, Heiner Röhr (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 into Scientific Computing [EWR]

Coordinators: W. Dörfler, V. Heuveline, M. Hochbruck, T. Jahnke, A. Rieder, C. Wieners

Part of the modules: Introduction into Scientific Computing (p. [52](#))[MATHMWNM05]

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

Learning Control / Examinations

exam:

written or oral exam or practical

Marking:

grade of exam

Conditions

None.

Recommendations

It is recommended to attend the following modules previously:

Analysis 1+2

Linear Algebra 1+2

Programming: Introduction into Computer Science

Numerical Mathematics 1+2

Numerical Methods for Differential Equations

Learning Outcomes

The students know the basic methods and algorithms of scientific computing. The focus is on modelling and the algorithmic realisation. They learn techniques to judge the quality of the simulations.

Content

Course: Theory of endogenous growth [2561503]**Coordinators:** I. Ott**Part of the modules:** Innovation and growth (p. 93)[MATHMWVWLIWW1], Growth and Agglomeration (p. 94)[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

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. [89](#))[MATHMWBLIP5]

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

Learning Control / Examinations

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

Conditions

None.

Learning Outcomes**Content**

Course: Energy Systems Analysis [2581002]**Coordinators:** V. Bertsch**Part of the modules:** Energy Economics and Technology (p. [89](#))[MATHMWBLIP5]

ECTS Credits	Hours per week	Term	Instruction language
3	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**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. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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.

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: Enterprise Risk Management [2530326]

Coordinators: U. Werner

Part of the modules: Operational Risk Management II (p. 87)[MATHMWBWLFBV10], Operational Risk Management I (p. 86)[MATHMWBWLFBV9]

ECTS Credits	Hours per week	Term	Instruction language
4,5	3/0	Winter 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. term papers (50 percent) and the assessment of the oral exam (50 percent).

Conditions

None.

Learning Outcomes

Learning to identify, to analyse and to assess business risks; this serves as a basis for strategy and policy design regarding risks and opportunities of an enterprise. Introduction to approaches that allow to consider area-specific risk objectives, risk-bearing capacity and risk acceptance.

Content

1. Concepts and practice of risk management, based on decision theory
2. Goals, strategies and policies for the identification, analysis, assessment and management of risks
3. Insurance as an instrument for loss-financing
4. Selected aspects of risk management: e.g. environmental protection, organizational failure and D&O-coverage, development of a risk management culture
5. Organisation of risk management
6. Approaches for determining optimal combinations of risk management measures considering their investment costs and outcomes.

Literature

- K. Hoffmann. Risk Management - Neue Wege der betrieblichen Risikopolitik. 1985.
- R. Hölscher, R. Elfgen. Herausforderung Risikomanagement. Identifikation, Bewertung und Steuerung industrieller Risiken. Wiesbaden 2002.
- W. Gleissner, F. Romeike. Risikomanagement - Umsetzung, Werkzeuge, Risikobewertung. Freiburg im Breisgau 2005.
- H. Schierenbeck (Hrsg.). Risk Controlling in der Praxis. Zürich 2006.

Elective literature:

Additional literature is recommended during the course.

Remarks

For organizational reasons, please register with the secretary of the chair: thomas.mueller3@kit.edu.

Course: Decision Theory [2520365]**Coordinators:** K. Ehrhart**Part of the modules:** Decision and Game Theory (p. 92)[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.

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. Edition.
- Berninghaus, S.K., K.-M. Ehrhart und W. Güth (2006): Strategische Spiele. Berlin u.a.: Springer, 3., Edition

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

Coordinators: S. Nickel, S. Spieckermann

Part of the modules: Operations Research in Supply Chain Management and Health Care Management (p. 100)[MATHMWOR8]

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

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 course covers basic concepts of discrete event simulation models and qualifies students for the computer-based usage of simulation systems. This enables students to structure simulation studies according to process models. Additionally, students deepen their knowledges for logical issues and discover the importance of statistical methods in modeling and evaluation of simulation models. Students gain insight to coupled systems of simulation and meta-heuristics, and they are able to characterize 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: Evolution Equations [MATHAN12]**Coordinators:** R. Schnaubelt, L. Weis**Part of the modules:** Evolution Equations (p. [43](#))[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: M. Adam, C. Weinhardt

Part of the modules: Decision and Game Theory (p. 92)[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 empirical 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

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.

Remarks

The Lecture was taken over by Marc Adam, PhD, in the winter term 2011/12.

Course: Fixed Income Securities [2530260]**Coordinators:** M. Uhrig-Homburg**Part of the modules:** Finance 2 (p. 84)[MATHMWBWLFVB2], Finance 3 (p. 85)[MATH4BWLFVB11]

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.

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, South-Western College Publishing, (1997).

Elective literature:

- Hull, J., Options, Futures, & Other Derivatives, Prentice Hall, Sixth Edition, (2005).

Course: Financial Intermediation [2530232]**Coordinators:** M. Ruckes**Part of the modules:** Finance 3 (p. 85)[MATH4BWLFBV11], Finance 2 (p. 84)[MATHMWBWLFBV2]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes

Students are introduced to the theoretical fundamentals of financial intermediation.

Content

- Arguments for the existence of financial intermediaries
- Bank loan analysis, relationship lending
- Competition in the banking sector
- Stability of the financial system
- The macroeconomic role of financial intermediation

Literature**Elective literature:**

- Hartmann-Wendels/Pfingsten/Weber (2006): Bankbetriebslehre, 4. Auflage, Springer Verlag.
- Freixas/Rochet (1997): Microeconomics of Banking, MIT Press.

Course: Mathematical Finance in Discrete Time [FMDZ]**Coordinators:** N. Bäuerle**Part of the modules:** Mathematical Finance in Discrete Time (p. 66)[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.

Recommendations

It is recommended to attend the following modules previously:

Analysis 3

Probability Theory

Learning Outcomes**Content**

Course: Mathematical Finance in Continuous Time [MATHST08]**Coordinators:** N. Bäuerle**Part of the modules:** Mathematical Finance in Continuous Time (p. [70](#))[MATHMWST08]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Course: Financial Statistics [MATHST19]**Coordinators:** N. Henze, C. Kirch, B. Klar**Part of the modules:** Financial Statistics (p. [79](#))[MATHST19]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	Winter / Summer 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. [45](#))[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, M. Plum, W. Reichel, C. Schmoeger, R. Schnaubelt, L. Weis**Part of the modules:** Functional Analysis (p. 37)[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

Introduction into functional analytic concepts and methods

Content

- metric spaces (topological concepts, compactness)
- continuous linear operators on Banach spaces (principle of uniform boundedness, open mapping theorem)
- dual spaces, representation theorems theorem of Hahn-Banach, weak convergence, reflexivity
- distributions, weak derivatives, Fourier transform, theorem of Plancherel, Sobolev spaces in L^2 , partial differential equations with constant coefficients

Course: Mixed Integer Programming I [25138]

Coordinators: O. Stein
Part of the modules: Mathematical Programming (p. 102)[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.

In a combined examination of *Mixed Integer Programming I* [25138] and *Mixed Integer Programming II* [25140], upon attaining more than 60% of the exercise points, the grade of the passed examination is improved by a third of a grading step.

In a combined examination of *Mixed Integer Programming I* [25138] and *Mixed Integer Programming II* [25140], upon attaining more than 60% of the computer exercise points, the grade of the passed examination is improved by a third of a grading step.

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.

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. 102)[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.

In a combined examination of *Mixed Integer Programming I* [25138] and *Mixed Integer Programming II* [25140], upon attaining more than 60% of the exercise points, the grade of the passed examination is improved by a third of a grading step.

In a combined examination of *Mixed Integer Programming I* [25138] and *Mixed Integer Programming II* [25140], upon attaining more than 60% of the computer exercise points, the grade of the passed examination is improved by a third of a grading step.

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.

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, C. Kirch, B. Klar**Part of the modules:** Generalized Regression Models (p. [71](#))[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**Part of the modules:** Geometry of Schemes (p. [30](#))[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, G. Weitze-Schmithüsen

Part of the modules: Geometric Group Theory (p. [31](#))[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.

Recommendations

It is recommended to attend the following modules previously:

Introduction into Algebra and Number Theory

Introduction into Geometry and Topology

Learning Outcomes

Understanding of the interplay between geometry and group theory

Content

- Group actions on topological spaces and geometric spaces
- Locally homogeneous spaces
- Discrete and continuous symmetry groups

Course: Geometric Measure Theorie [1040]**Coordinators:** D. Hug**Part of the modules:** Geometric Measure Theory (p. [27](#))[MATHMWAG08]

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

The students

- know fundamental results and techniques of proof of geometric measure theory,
- know examples of applications of methods of geometric measure theory and apply these methods.

Content

- Measure and integral
- Covering Theorems
- Hausdorff Measures
- Differentiation of Measures
- Lipschitz Functions and Rectifiability
- Area and Coarea Formula
- Currents
- Applications

Course: Geometric numerical integration [MATHNM31]**Coordinators:** M. Hochbruck, T. Jahnke**Part of the modules:** Geometric numerical integration (p. [65](#))[MATHNM31]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	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 3 (p. 85)[MATH4BWLFBV11], Finance 2 (p. 84)[MATHMWBWLFBV2]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes

Students are told the basics of commercial banking.

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.

Literature**Elective literature:**

- A script is disseminated chapterwise within the lecture.
- Hartmann-Wendels, Thomas; Pfingsten, Andreas; Weber, Martin; 2000, Bankbetriebslehre, 2. Auflage, Springer

Course: Global Optimization I [2550134]**Coordinators:** O. Stein**Part of the modules:** Applications of Operations Research (p. 96)[MATHMWOR5], Mathematical Programming (p. 102)[MATHMWOR9], Methodical Foundations of OR (p. 98)[MATHMWOR6]

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 *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,
- is able to choose, design and apply modern techniques of deterministic global optimization 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.

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. 98)[MATHMWOR6], Mathematical Programming (p. 102)[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 to the written examination 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,
- is able to choose, design and apply modern techniques of deterministic global optimization 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 α BB 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.

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. 102)[MATHMWOR9]

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

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 lecture is divided into two parts: In the first part “Graph Theory“, basic concepts and algorithms of Graph Theory are presented, which are used in engineering, economic and socio-scientific problems. The students become acquainted with models and methods in order to optimize on graphs and networks. The second part “Advanced Location Models” addresses some selected advanced topics of location theory. The students become familiar with praxis-relevant and current research topics and learn about solution concepts of different location problems.

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 and 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.

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 planned to be held in the winter term 2014/2015. The lecture is not held in summer 2013 due to a research semester.

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

Course: Graphs and Groups [MATHAG17]**Coordinators:** F. Herrlich, G. Weitze-Schmithüsen**Part of the modules:** Graphs and Groups (p. [33](#))[MATHMWAG17]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Course: Graph Theory [GraphTH]**Coordinators:** M. Axenovich**Part of the modules:** Graph Theory (p. 35)[MATHAG26]

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

Learning Control / Examinations

Examination: written or oral exam

Marking: grade of examination

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. 93)[MATHMWVWLIWW1]

ECTS Credits	Hours per week	Term	Instruction language
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

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.

Remarks

The credits have been changed from 4,5 to 5.

Course: Insurance Accounting [2530320]**Coordinators:** E. Schwake**Part of the modules:** Insurance Management I (p. [88](#))[MATHMWBWLFBV6]

ECTS Credits	Hours per week	Term	Instruction language
4,5	3/0	Winter term	de

Learning Control / Examinations

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

Conditions

None.

Learning Outcomes**Content****Literature****Elective literature:**

K. Küting, C.-P. Weber. Bilanzanalyse, Lehrbuch zur Beurteilung von Einzel- und Konzernabschlüssen. 1997

W. Rockel, E. Helten, H.Loy. Versicherungsbilanzen - Rechnungslegung nach HGB, US-GAAP und IAS/IFRS. 2005

H.Treuberg, B.Angermayer. Jahresabschluss von Versicherungsunternehmen. 1995.

Remarks

Block course. To attend the course please register at the secretariat of the chair of insurance science.

Course: Insurance Marketing [2530323]**Coordinators:** E. Schwake**Part of the modules:** Insurance Management I (p. 88)[MATHMWBWLFVB6]

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.

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

Remarks

For organizational reasons, please register with the secretary of the chair: thomas.mueller3@kit.edu.

Course: Insurance Production [2530324]**Coordinators:** U. Werner**Part of the modules:** Insurance Management I (p. 88)[MATHMWBWLFVB6]

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.

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>

For organizational reasons, please register with the secretary of the chair: thomas.mueller3@kit.edu.

Course: Insurance Risk Management [2530335]**Coordinators:** H. Maser**Part of the modules:** Insurance Management I (p. 88)[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**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. 38)[MATHMWAN07]

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

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

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: Intelligent Systems in Finance [2511402]

Coordinators: D. Seese

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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

Learning Control / Examinations

The assessment is a written examination.

See the German part for special requirements to be admitted for the examination.

Conditions

None.

Learning Outcomes

- The students acquire abilities and knowledge of methods and systems from the area of machine learning and learn how to use them in the area of finance, which is the core area of application of this lecture.
- It is taught the ability to choose and change these methods and systems adequate to the situation and to use them for problem solving in the area of finance.
- The students get the ability to find strategic and creative answers in their search for solutions for precisely defined, concrete and abstract problems.
- At the same time the lecture aims to give foundational knowledge and methods in the context of their application in practise. On the basis of the basic understanding of concepts and methods of informatics the students should be able to comprehend quickly the new developments in the area and to use them correctly.

Content

A new generation of computing methods, commonly known as “intelligent systems”, has recently been successfully applied to a variety of business and financial modelling tasks. In many application fields these novel methods outperform traditional statistical techniques. The lecture provides a comprehensive coverage of the area, including foundations and applications. In particular it deals with intelligent software agents, genetic algorithms, neural networks, support vector machines, fuzzy-logic, expert systems and intelligent hybrid systems. The presented applications focus on the finance area and are related to risk management (credit risk, operational risk), financial trading, portfolio management and economic modelling. The lecture is given in cooperation with the company msgGILLARDON. The lecture starts with an introduction of the central problems of application in this area, e.g. decision support for investors, Portfoliosselection under constraints, information retrieval from business reports, automatic development of trading rules for the capital market, modelling of time series at the capital market, explanation of phenomena at capital markets by simulation, decision support in risk management (credit risk, operational risk). After this the basics of intelligent systems are discussed. Basic ideas and essential results for different stochastic heuristics for local search are discussed next, especially Hill Climbing, Simulated Annealing, Threshold Accepting and Tabu Search. After this different population-based approaches of evolutionary methods are presented, e.g. Genetic Algorithms, Evolutionary Strategies and Programming, Genetic Programming, Memetic Algorithms and Ant-Algorithms. It follows an introduction into Neural Networks, Support Vector Machines and Fuzzylogic. Softwareagents and agentbased stock market models are the next topic. The lecture ends with an overview on the complexity of algorithmic problems in the area of finance, giving in this way one of the key reasons for the necessity to use heuristics and intelligent systems. Essential examples and basic applications are chosen from the area of finance.

Media

Slides.

Literature

There is no text book covering completely the content of the lecture.

- Z. Michalewicz, D. B. Fogel. How to Solve It: Modern Heuristics. Springer 2000.
- J. Hromkovic. Algorithms for Hard Problems. Springer-Verlag, Berlin 2001.
- Christopher M. Bishop: Pattern Recognition and Machine Learning, Springer 2006
- P. Winker. Optimization Heuristics in Econometrics. John Wiley & Sons, Chichester 2001.
- A. Brabazon, M. O'Neill. Biologically Inspired Algorithms for Financial Modelling. Springer, 2006.
- A. Zell. Simulation Neuronaler Netze. Addison-Wesley 1994.
- R. Rojas. Theorie Neuronaler Netze. Springer 1993.
- N. Cristianini, J. Shawe-Taylor. An Introduction to Support Vector Machines and other kernel-based learning methods. Cambridge University Press 2003.

- G. Klir, B. Yuan. Fuzzy Sets and Fuzzy Logic: Theory and Applications. Prentice-Hall, 1995.
- F. Schlottmann, D. Seese. Modern Heuristics for Finance Problems: A Survey of Selected Methods and Applications. In S. T. Rachev (Ed.) Handbook of Computational and Numerical Methods in Finance, Birkhäuser, Boston 2004, pp. 331 - 359.

Further references will be given in each lecture.

Elective literature:

- S. Goonatilake, Ph. Treleaven (Eds.). Intelligent Systems for Finance and Business. John Wiley & Sons, Chichester 1995.
- F. Schlottmann, D. Seese. Financial applications of multi-objective evolutionary algorithms, recent developments and future directions. Chapter 26 of C. A. Coello Coello, G. B. Lamont (Eds.) Applications of Multi-Objective Evolutionary Algorithms, World Scientific, New Jersey 2004, pp. 627 - 652.
- D. Seese, F. Schlottmann. Large grids and local information flow as reasons for high complexity. In: G. Frizelle, H. Richards (eds.), Tackling industrial complexity: the ideas that make a difference, Proceedings of the 2002 conference of the Manufacturing Complexity Network, University of Cambridge, Institute of Manufacturing, 2002, pp. 193-207. (ISBN 1-902546-24-5).
- R. Almeida Ribeiro, H.-J. Zimmermann, R. R. Yager, J. Kacprzyk (Eds.). Soft Computing in Financial Engineering. Physica-Verlag, 1999.
- S. Russel, P. Norvig. Künstliche Intelligenz Ein moderner Ansatz. 2. Auflage, Pearson Studium, München 2004.
- M. A. Arbib (Ed.). The Handbook of Brain Theory and neural Networks (second edition). The MIT Press 2004.
- J.E. Gentle, W. Härdle, Y. Mori (Eds.). Handbook of Computational Statistics. Springer 2004.
- F. Schweitzer. Brownian Agents and Active Particles. Collective Dynamics in the Natural and Social Sciences, Springer 2003.
- D. Seese, C. Weinhardt, F. Schlottmann (Eds.) Handbook on Information Technology in Finance, Springer 2008.
- Further references will be given in the lecture.

Remarks

The content of the lecture will permanently be adapted to actual developments. This can be the cause to changes of the described content and schedule.

The course "Intelligent Systems in Finance" will not be offered any more from summer term 2016 on. The examination will be offered latest until summer term 2015 (repeaters only).

Course: International Marketing [2572155]**Coordinators:** M. Klarmann**Part of the modules:** Marketing Management (p. 91)[MATHMWBWLMAR5]

ECTS Credits	Hours per week	Term	Instruction language
1,5	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.

Learning Outcomes**Content**

Doing marketing abroad creates a number of significant new challenges for firms. This class is intended to prepare you for meeting these challenges. In the first session, we will discuss the peculiarities of international marketing. The next five sessions will then be dedicated to methods that can be used to address them. For instance, we will look at the following issues:

- Internationalization strategies
- Market entry strategies
- Standardization vs. individualization (e.g. regarding products, prices, and communication)
- Measurement equivalence in international market research

In the final session, we will apply this knowledge to the case of Wal Mart. In particular, Wal Mart, despite being the largest retailing company worldwide, failed to successfully enter the German Market. We will discuss Wal Mart's failure using the methods taught in the weeks before.

Remarks

For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).

Course: International Risk Transfer [2530353]**Coordinators:** W. Schwehr**Part of the modules:** Insurance Management I (p. 88)[MATHMWBWLFBV6], Operational Risk Management I (p. 86)[MATHMWBWLFBV9], Operational Risk Management II (p. 87)[MATHMWBWLFBV10]

ECTS Credits	Hours per week	Term	Instruction language
2,5	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.

Learning Outcomes

Becoming acquainted with the various possibilities of international risk transfer.

Content

How are the costs of potential major damages financed and covered on a global scale? Traditionally, direct insurers and, especially, reinsurers are conducting a global business, Lloyd's of London is a turntable for international risks, and global industrial enterprises are establishing captives for self insurance. In addition to this, capital markets and insurance markets are developing innovative approaches to cover risks, which were hard to insure in the past (e.g. weather risk). The lecture will elucidate the functioning and the background of these different possibilities of international risk transfer.

Literature

- P. Liebwein. Klassische und moderne Formen der Rückversicherung. Karlsruhe 2000
- Brühwiler/ Stahlmann/ Gottschling. Innovative Risikofinanzierung - Neue Wege im Risk Management. Wiesbaden 1999.
- Becker/ Bracht. Katastrophen- und Wetterderivate. Finanzinnovationen auf der Basis von Naturkatastrophen und Wettererscheinungen, Wien 1999.

Remarks

Block course. For organizational reasons, please register at the secretary of the chair: thomas.mueller3@kit.edu.

Course: International Finance [2530570]**Coordinators:** M. Uhrig-Homburg, Dr. Walter**Part of the modules:** Finance 3 (p. 85)[MATH4BWLFBV11], Finance 2 (p. 84)[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.

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. 94)[MATHMWVWL12]

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

Learning Control / Examinations

The assessment consists of a written exam (60min) 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.

Conditions

None.

Recommendations

Previous visit of the lectures *Economics II: Macroeconomics* [2600014] is recommended.

Learning Outcomes**Content****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 credits have been changed to 5.

Course: Cost and Management Accounting [2530210]

Coordinators: T. Lüdecke

Part of the modules: Finance 3 (p. 85)[MATH4BWLFBV11], Finance 2 (p. 84)[MATHMWBWLFBV2]

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

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.

Course: Inverse Problems [01052]**Coordinators:** T. Arens, F. Hettlich, A. Kirsch, A. Rieder**Part of the modules:** Inverse Problems (p. [53](#))[MATHMWNM06]

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

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:** M. Plum, W. Reichel, R. Schnaubelt, L. Weis**Part of the modules:** Classical Methods for Partial Differential Equations (p. [39](#))[MATHMWAN08]

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: Knowledge Discovery [2511302]**Coordinators:** R. Studer**Part of the modules:** Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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

Familiarity with fundamentals of Knowledge Discovery, Data Mining and Machine Learning. Standard algorithms, representations, applications and processes needed for knowledge discovery projects are covered.

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 empirical 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 feature vector-based learning, text mining and social network analysis.

Media

Slides.

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: Control Theory [MATHAN18]**Coordinators:** R. Schnaubelt, L. Weis**Part of the modules:** Control Theory (p. [46](#))[MATHMWAN18]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Course: Convex Geometry [1044]**Coordinators:** D. Hug**Part of the modules:** Convex Geometry (p. 26)[MATHMWAG07]

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

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. 100)[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

Students gain insight into fundamental work flows in hospitals. They learn that the application of Operations Research methods can also be useful in so-called non-profit-organisations. In addition, the most important application areas for mathematical models, e.g. personnel planning or quality management, will be discussed.

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. 84)[MATHMWBWLFBV2], Finance 3 (p. 85)[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

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, Chapman & Hall, CRC Financial Mathematics Series, (2002).
- Duffie, D., Singleton, K.J., Credit Risk: Pricing, Measurement and Management, Princeton Series of Finance, Prentice Hall, (2003).

Course: Lévy Processes [MATHST21]**Coordinators:** V. Fasen, G. Last**Part of the modules:** Lévy Processes (p. [81](#))[MATHST21]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Course: Lie Groups and Lie Algebras [MATHAG13]**Coordinators:** O. Baues**Part of the modules:** Lie Groups and Lie Algebras (p. [32](#))[MATHMWAG13]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Course: Solution methods for linear and nonlinear equations [LLNGS]**Coordinators:** W. Dörfler, A. Rieder, C. Wieners**Part of the modules:** Solvers for linear and nonlinear systems of equations (p. [56](#))[MATHMWNM10]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Course: Management of IT-Projects [2511214]

Coordinators: R. Schätzle

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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 know the terminology of IT project management and typical used methods for planning, handling and controlling. They are able to use methods appropriate to current project phases and project contexts and they know how to 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 infrastrukt
- project controlling
- risk management
- feasibility studies
- decision processes, conduct of negotiations, time management.

Media

Slides, access to internet resources.

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. [104](#))[MATHMWINFO1], Emphasis in Informatics (p. [106](#))[MATHMWINFO2]

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

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. [91](#))[MATHMWBWLMAR5]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**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: Market Research [2571150]**Coordinators:** M. Klarmann**Part of the modules:** Marketing Management (p. 91)[MATHMWBWLMAR5]

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

Learning Control / Examinations**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**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. 85)[MATH4BWLFBV11], Finance 2 (p. 84)[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 inventory and/or asymmetric information affect market prices and the pricing of securities. Theoretical models are shown to provide predictions which are consistent with empirical 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.

Literature

keine

Elective literature:

See reading list.

Remarks

This lecture was not exceptionally taught in the winter semester 2011/12. The corresponding exams however took place as usual.

Only in the winter term 2011/12 the lecture could be replaced by the lecture eFinance: Information Engineering and Management for Securities Trading [2540454] within the corresponding module. Who wanted to replace it in this way had to make the first attempt at passing the examination at the regular examination dates of this winter term 2011/12. The general regulation concerning the second attempt at passing the examination remains unchanged.

Course: Mathematical Statistics [MATHST15]**Coordinators:** N. Henze, C. Kirch, B. Klar**Part of the modules:** Mathematical Statistics (p. [76](#))[MATHMWST15]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Course: Methods of Fourier Analysis [MATHAN35]**Coordinators:** P. Kunstmann, R. Schnaubelt, L. Weis**Part of the modules:** Methods of Fourier Analysis (p. [50](#))[MATHAN35]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	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. 90)[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

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. 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.

Within the chapter concerning leadership frameworks the students are given the possibility to individually analyze their management style on the basis of classical concepts of leadership. These concepts will be presented and discussed in detail.

Content

- Principles of strategic management decisions
- Leadership: Classical leadership concepts
- Basic economic decision models
- Limits of the basic models and advanced concepts
- Advanced models: individual decisions with uncertainty and vague information

Media

Slides.

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.
- Scholz, C.: *Personalmanagement*. Vahlen, 5. Aufl. München 2000, Kap. 9.4, S.923 - 948

Course: Business Process Modelling [2511210]

Coordinators: A. Oberweis

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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 goals of business process modelling and master different modelling languages. They are able to choose the appropriate modelling language according to a given context and to use the modelling language with suitable modelling tools. They master methods for analysing and assessing process models and methods for analysing them according to specific quality characteristics.

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.

Literature

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. [88](#))[MATHMWBWLFBV6]

ECTS Credits	Hours per week	Term	Instruction language
2.5/3	2	Summer term	de

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Course: Multidisciplinary Risk Research [2530328]

Coordinators: U. Werner

Part of the modules: Operational Risk Management II (p. 87)[MATHMWBWLFVB10], Operational Risk Management I (p. 86)[MATHMWBWLFVB9]

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

- Getting an overview of the various theoretical, empirical and methodological approaches used in risk research.
- Learning to assess disciplinary perspectives and approaches.
- Detailed examination of at least one theoretical and one methodological approach by the analysis of research papers and case studies.

Content

The course consists of two parts:

In the theoretical part risk concepts of various disciplines are discussed as well as categorisations of risk (e.g. technical or natural origin) and of risk carriers. Based on empirical research, processes of risk perception, risk assessment, and risk taking – at the individual, institutional, and global level – are described and explained.

The methodological part of the course deals with hazard research, approaches for identification and mapping of risks and their accumulations, as well as with safety culture research. Using empirical studies, survey methods regarding risk perception and risk assessment are discussed. Specific problems in the context of intercultural research are considered too.

All students participate actively in the lecture. Per person, at least one presentation and one elaboration are expected.

Literature

- U. Werner, C. Lechtenbörger. Risikoanalyse & Risikomanagement: Ein aktueller Sachstand der Risikoforschung. Arbeitspapier 2004
- Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen (WBGU). Welt im Wandel: Strategien zur Bewältigung globaler Umweltrisiken. Jahresgutachten 1998, http://www.wbgu_jg1998.html.
- R. Löfstedt, L. Frewer. Risk and Modern Society, London 1998.
- <http://www.bevoelkerungsschutz.ch>

Elective literature:

Additional literature is recommended during the course.

Remarks

For organizational reasons, please register with the secretary of the chair: thomas.mueller3@kit.edu.

Course: Nature-inspired Optimisation Methods [2511106]

Coordinators: S. Mostaghim, P. Shukla

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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", 60 min (according Section 4(2), 3 of the examination regulation) or a selection of exercises. 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

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:** Methodical Foundations of OR (p. 98)[MATHMWOR6], Stochastic Methods and Simulation (p. 99)[MATHMWOR7], Mathematical Programming (p. 102)[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 (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 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 *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 nonlinear optimization,
- is able to choose, design and apply modern techniques of 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 conditions 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.

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. 98)[MATHMWOR6], Mathematical Programming (p. 102)[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 30% of the exercise points. Therefore the online-registration for 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 nonlinear optimization,
- is able to choose, design and apply modern techniques of 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.

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, C. Kirch, B. Klar**Part of the modules:** Nonparametric statistics (p. [77](#))[MATHMWST16]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Course: Numerical Methods for Integral Equations [MATHNM29]**Coordinators:** T. Arens**Part of the modules:** Numerical Methods for Integral Equations (p. [63](#))[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 Differential Equations [NMDG]

Coordinators: W. Dörfler, V. Heuveline, A. Rieder, C. Wieners

Part of the modules: Numerical Methods for Differential Equations (p. 51)[MATHMWNM03]

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:

Analysis 1+2

Linear Algebra 1+2

Programming: Introduction into Computer Science

Numerical Mathematics 1+2

Learning Outcomes

The students know basic methods and algorithms to solve differential equations. All aspects from modelling to questions of stability and convergence will be considered.

Content

1. Initial value problems
 - 1.1. Introduction
 - 1.2. Explicit timestepping
 - 1.3. Timestep control
 - 1.4. Extrapolation
 - 1.5. Multistep methods
 - 1.6. Implicit Timestepping
 - 1.7. Stability
2. Boundary value problems
 - 2.1. Finite difference methods
 - 2.2. Variational methods
3. Introduction into numerical methods for PDEs
 - 3.1. Elliptic Equations
 - 3.2. Parabolic Equations (1-D)
 - 3.3. Hyperbolic Equations (1-D)

Course: Numerical Methods for Time-Dependent PDE [MATHNM20]**Coordinators:** W. Dörfler**Part of the modules:** Numerical Methods for Time-Dependent PDE (p. [60](#))[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 Mathematical Finance [MATHNM18]**Coordinators:** T. Jahnke, C. Wieners**Part of the modules:** Numerical Methods in Mathematical Finance (p. [59](#))[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, C. Wieners**Part of the modules:** Numerical methods in mathematical finance II (p. [62](#))[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 Optimization Methods [MATHNM25]**Coordinators:** V. Heuveline, C. Wieners**Part of the modules:** Numerical Optimization Methods (p. [61](#))[MATHMWNM25]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

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. 100)[MATHMWOR8]

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

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 target of this lecture is to show possible applications of well-known methods of Operations Research applied to health services. The students gain 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. Furthermore the advantages and benefits of simulation models and OR methods to plan home health care services are discussed.

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.

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 planned to be held in the summer term 2014.

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. 100)[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 lecture conveys basic and advanced modeling techniques playing an important role in today's problem solving occurring in supply networks. The focus is set on mathematical approaches to technical-economical problems, and the derivation of optimal solutions. Students are enabled to classify problems both conceptually and mathematically, and to identify central variables and parameters in a specific problem setting. Additionally, current developments in operations research and supply chain management are reflected and evaluated by students.

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.

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 2013/14.

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. 103)[MATHMWOR10]

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

Learning Control / Examinations**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 economics, engineering, and natural sciences. Subject matter of the course will be announced in due time.

Media

Blackboard, Slides, Flash Animations, Simulation Software

Literature

Lecture Notes.

Elective literature:

problem-oriented

Remarks

The lecture is offered irregularly. The curriculum of the next two years is available online.

Course: Optimization and Optimal Control for Differential Equations [MATHNM09]**Coordinators:** V. Heuveline**Part of the modules:** Optimization and Optimal Control for Differential Equations (p. [55](#))[MATHMWNM09]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	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. 103)[MATHMWOR10]

ECTS Credits	Hours per week	Term	Instruction language
4,5	1/0/3	Winter / Summer Term	de

Learning Control / Examinations

Presentation and documentation of the results.

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 in 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 economics, engineering, and natural sciences. Subject matter of the course will be announced in due time.

Media

Blackboard, Slides, OR-Lab

Literature

Problem oriented

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. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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).

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. 90)[MATHMWUO1]

ECTS Credits	Hours per week	Term	Instruction language
4	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

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 organisational 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.

Content

- Principles of organisational management
- Managing organisational structures and processes: the selection of design parameters
- Ideal-typical organisational structures: choice and effect of parameter combinations
- Managing organisational changes

Media

Slides.

Literature

- Laux, H.; Liermann, F.: *Grundlagen der Organisation*, Springer. 6. Aufl. Berlin 2005.
- Lindstädt, H.: *Organisation*, in Scholz, C. (Hrsg.): *Vahlens Großes Personalexikon*, 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.

Course: Organization Theory [2577904]

Coordinators: H. Lindstädt

Part of the modules: Strategic Corporate Management and Organization (p. 90)[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, models on incentive systems and relative performance tournaments as well as selected OR optimisation approaches to designing organisational structures. The course therefore lays the basis for a deeper understanding of the advanced literature on this key economic area.

Content

- Basic considerations and institution-economic principles of organisational theory
- Transfer prices and internal market-price relationships
- Design and coordination without conflicting objectives
- Economic evaluation of information
- Organisation under asymmetric information and conflicting objectives: agency theory principles

Media

Folien.

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.

Course: P+C Insurance Game [INSGAME]**Coordinators:** U. Werner**Part of the modules:** Insurance Management I (p. [88](#))[MATHMWBWLFBV6]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Course: Parallel Computing [MATHNM08]**Coordinators:** V. Heuveline, J. Weiß**Part of the modules:** Parallel Computing (p. [54](#))[MATHMWNM08]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Course: Percolation [MATHST13]**Coordinators:** G. Last**Part of the modules:** Percolation (p. [74](#))[MATHMWST13]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Course: Portfolio and Asset Liability Management [2520357]**Coordinators:** Y. Kim**Part of the modules:** Mathematical and Empirical Finance (p. 95)[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

Introduction and deepening of various portfolio management techniques in the financial industry.

Content

Portfolio theory: principles of investment, Markowitz- portfolio analysis, Modigliani-Miller theorems and absence of arbitrage, efficient markets, capital asset pricing model (CAPM), multi factorial CAPM, arbitragepricing theory (APT), arbitrage and hedging, multi factorial models, equity-portfolio management, passive strategies, active investment

Asset liability: statistical portfolio analysis in stock allocation, measures of success, dynamic multi seasonal models, models in building scenarios, stochastic programming in bond and liability management, optimal investment strategies, integrated asset liability management

Media

transparencies, exercises.

Literature

To be announced in lecture.

Elective literature:

To be announced in lecture.

Course: Computing Lab Information Systems [PraBI]

Coordinators: A. Oberweis, D. Seese, R. Studer

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

ECTS Credits	Hours per week	Term	Instruction language
5	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 with a minimal learning curve by using format requirements such as those recommended by well-known publishers.
- give presentations in a scientific context in front of an auditorium. These techniques are presented and learn during the course.
- present results of the research in written form generally found in scientific publications.

Content

The lab intensifies and extends specific topics which are discussed within corresponding lectures. Knowledge of these lecture topics is an advantage but not a precondition.

Media

Slides, Access to internet resources

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. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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

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>

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: Computing Lab in Intelligent Systems in Finance [25762p]**Coordinators:** D. Seese**Part of the modules:** Informatics (p. [104](#))[MATHMWINFO1], Emphasis in Informatics (p. [106](#))[MATHMWINFO2]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Winter / Summer Term	de

Learning Control / Examinations

see German version

Conditions

see German version

Learning Outcomes

see German version

Content

see German version

Literature**Elective literature:**

Literature will be announced in the first meeting.

Remarks

see German version

Course: Computing Lab in Complexity Management [25818]**Coordinators:** D. Seese**Part of the modules:** Informatics (p. [104](#))[MATHMWINFO1], Emphasis in Informatics (p. [106](#))[MATHMWINFO2]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Winter / Summer Term	de

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content****Literature**

Will be announced in the computing lab.

Course: Lab Class Web Services [25820]**Coordinators:** S. Tai**Part of the modules:** Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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

Learning Control / Examinations

The assessment of this course is according to §4(2), 3 of the examination regulation in form of an examination of the written seminar thesis, a presentation and a project. The final mark is based on the examination of the written seminar thesis and the project but can be upgraded or downgraded according to the quality of the presentation.

Conditions

None.

Recommendations

The lectures *Service Oriented Computing 1* and/or *Cloud Computing* are recommended.

Learning Outcomes

Students will acquire the technical expertise to apply service-oriented platforms and tools. Thereby, they will be enabled to develop practical solutions for concrete problems of constructing service-oriented IT infrastructure for provision of electronic services over the Internet.

Content

The “Praktikum (lab class) Web Services” provides a practical introduction to fundamental Web service technologies and their application to support applications on the Internet. Based on concrete application scenarios, the class focuses on the development of software solutions for specific aspects of service-oriented IT-infrastructure. This includes the complete development lifecycle of a large-scale software project and its implementation in small project teams.

Literature

Will be announced at the kick-off event.

Course: Exercises in Knowledge Management [25740p]

Coordinators: R. Studer

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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

To autonomously comprehend and work on a topic in the area 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

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. 100)[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 practical seminar will take place in a hospital in Karlsruhe such that the students are confronted with real problems. The target of this seminar is to develop solutions for these problems using well-known methods of Operations Research. Consequently the students' ability to analyze processes and structures, to collect relevant data as well as to develop and solve models will be promoted.

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.

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: Principles of Insurance Management [2550055]**Coordinators:** U. Werner**Part of the modules:** Insurance Management I (p. 88)[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.

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.

Remarks

For organizational reasons, please register with the secretariat of the chair: thomas.mueller3@kit.edu.

Course: Private and Social Insurance [2530050]**Coordinators:** W. Heilmann, K. Besserer**Part of the modules:** Insurance Management I (p. 88)[MATHMWBWLFVB6]

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.

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/>

RemarksBlock course. For organizational reasons, please register with the secretariat of the chair: thomas.mueller3@kit.edu

Course: Product and Innovation Marketing [2571154]**Coordinators:** M. Klarmann**Part of the modules:** Marketing Management (p. 91)[MATHMWBWLMAR5]

ECTS Credits	Hours per week	Term	Instruction language
3	2/0	Summer term	de

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**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: Quality Control I [2550674]**Coordinators:** K. Waldmann**Part of the modules:** Stochastic Modelling and Optimization (p. 103)[MATHMWOR10]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes

The lecture provides students with knowledge of modern techniques in quality management. Students learn to use the techniques, such as control charts, experimental design, efficiently and targeted.

Content

Topics overview: Introduction to TQM, Statistical Process Control (control charts), Acceptance Sampling (sampling plans), Design and Analysis of Experiments

Media

Blackboard, Slides, Flash Animations.

Literature

Lecture Notes

Elective literature:

- Montgomery, D.C. (2005): Introduction to Statistical Quality Control (5e); 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. 103)[MATHMWOR10]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes

The lecture provides students with knowledge of modern techniques in reliability engineering.

Content

Topics overview: Reliability Theory (structure function, reliability of complex systems, modeling and estimating lifetime distributions, systems with repair), Maintenance

Media

Blackboard, Slides, Flash Animations.

Literature

Lecture Notes

Elective literature:

- ROSS, S.M.: Introduction to Probability Models (5 ed). Academic Press, 1993.
- KOHLAS, J.: Zuverlässigkeit und Verfügbarkeit. B.G. Teubner, Stuttgart, 1987.
- BIROLINI, 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. [75](#))[MATHMWST14]**ECTS Credits**
8**Hours per week**
4/2**Term**
Winter term**Instruction language****Learning Control / Examinations****Conditions**

None.

Learning Outcomes**Content**

Course: Boundary Value Problems and Eigenvalue Problems [RUEP]

Coordinators: M. Plum, W. Reichel, R. Schnaubelt, L. Weis

Part of the modules: Boundary Value Problems and Eigenvalue Problems (p. 40)[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.

Recommendations

It is recommended to attend the following modules previously:

Linear Algebra 1+2

Analysis 1-3

Differential Equations and Hilbert Spaces

Learning Outcomes

Profound understanding of concepts and methods in partial differential equations particularly for boundary and eigenvalue problems.

Content

- examples of boundary and eigenvalue problems from physics
- maximum principles for second order equations
- Sobolev spaces
- weak formulation of linear elliptic boundary value problems of second order
- Lax-Milgram lemma
- coercivity
- Fredholm alternative for boundary value problems
- eigenvalue theory for weakly formulated elliptic eigenvalue problems

Course: Capability maturity models for software and systems engineering [2511216]

Coordinators: R. Kneuper

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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 to CMMI
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.

Literature

Literature is given in each lecture individually.

Course: Risk Communication [2530395]**Coordinators:** U. Werner**Part of the modules:** Operational Risk Management II (p. 87)[MATHMWBWLFBV10], Operational Risk Management I (p. 86)[MATHMWBWLFBV9], Insurance Management I (p. 88)[MATHMWBWLFBV6]

ECTS Credits	Hours per week	Term	Instruction language
4,5	3/0	Winter 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.

Literature**Elective literature:**

R. Löffstedt, 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

Remarks

To attend the course please register with the secretary of the chair: thomas.mueller3@kit.edu

Course: Semantic Web Technologies I [2511304]

Coordinators: R. Studer, S. Rudolph, E. Simperl

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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 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.

Learning Outcomes

- Basic knowledge about the main ideas and the realisation of Semantic Web Technologies

Content

"Semantic Web" denotes an extension of the World Wide Web by meta data and applications in order to make the meaning (semantics) of data on the web usable by intelligent systems, e.g. in e-commerce and internet portals. Central to this is the representation and processing of knowledge in form of ontologies. This lecture provides the foundations for knowledge representation and processing for the corresponding technologies and presents example applications. It covers the following topics:

- Extensible Markup Language (XML)
- Resource Description Framework (RDF) and RDF Schema
- Web Ontology Language (OWL)
- Rule Languages
- Applications

Media

Slides.

Literature

- Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, York Sure: Semantic Web - Grundlagen, Springer, 2008 (ISBN 978-3-540-33993-9)
- S. Staab, R. Studer (Editors). Handbook on Ontologies. International Handbooks in Information Systems. Springer 2003.

Elective literature:

1. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, Foundations of Semantic Web Technologies. Textbooks in Computing, Chapman and Hall/CRC Press, 2009.
2. G. Antoniou, Grigoris Antoniou, Frank Van Harmelen, A Semantic Web Primer, MIT Press, 2004
3. Uwe Schöning. Logik für Informatiker. Spektrum Akademischer Verlag, 5. Auflage 2000
4. Steffen Hölldobler. Logik und Logikprogrammierung. Synchron Verlag, 3. Auflage 2003
5. Dieter Fensel. Spinning the Semantic Web. 2003 (ISBN 0262062321).
6. Handschuh, Staab. Annotation for the Semantic Web. 2003 (ISBN 158603345X).
7. J. Sowa. Knowledge Representation. Brooks/Cole 1999
8. Tim Berners-Lee. Weaving the Web. Harper 1999 geb. 2000 Taschenbuch.
9. Ian Jacobs, Norman Walsh. Architecture of the World Wide Web, Volume One. W3C Recommendation 15 December 2004. <http://www.w3.org/TR/webarch/>

Course: Semantic Web Technologies II [2511306]

Coordinators: E. Simperl, A. Harth, S. Rudolph, Daniel Oberle

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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

Learning Control / Examinations

Written Examination (60 min) according to §4, Abs. 2, 1 of the examination regulations or oral examination of 20 minutes according to §4, Abs. 2, 2 of the examination regulations.

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.

Recommendations

Semantic Web Technologies I [2511304] is recommended.

Learning Outcomes

- Acquisition of basic competencies in Linked Data and data integration on the web
- Acquisition of advanced knowledge in knowledge representation with ontologies
- Acquisition of detailed knowledge of acquisition and evaluation of ontologies
- Analysis of typical usage scenarios and industry applications

Content

Central components of the Semantic Web are explained in detail. Linked Data foundations, crawling, querying and applications; knowledge representation, ontology modelling; ontology development and evaluation; Further, benefits and challenges of semantic technologies are discussed.

Media

Slides.

Literature

- Pascal Hitzler, Sebastian Rudolph, Markus Krötzsch: Foundations of Semantic Web Technologies. Chapman & Hall/CRC 2009.
- Steffen Staab, Rudi Studer (Editors). Handbook on Ontologies. International Handbooks in Information Systems. Springer 2003.
- John Domingue, Dieter Fensel, James A. Hendler (Editors). Handbook of Semantic Web Technologies. Springer 2011.

Elective literature:

1. Grigoris Antoniou, Frank Van Harmelen. A Semantic Web Primer. MIT Press, 2004
2. Uwe Schöning. Logik für Informatiker. Spektrum Akademischer Verlag, 2000
3. Steffen Hölldobler. Logik und Logikprogrammierung. Synchron Verlag, 2003
4. Dieter Fensel. Spinning the Semantic Web. MIT Press, 2003
5. John Sowa. Knowledge Representation. Brooks/Cole, 1999
6. Tim Berners-Lee. Weaving the Web. HarperOne, 1999
7. Dean Allemang. Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL. Morgan Kaufmann, 2008
8. Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernando Lopez: Ontological Engineering: with examples from the areas of Knowledge Management, e-Commerce and the Semantic Web. Springer, 2004
9. Nicola Guarino and Chris Welty. Identity, Unity, and Individuation: Towards a Formal Toolkit for Ontological Analysis. Proceedings of ECAI-2000: The European Conference on Artificial Intelligence. IOS Press, 2000
10. Nicola Guarino and Chris Welty. Evaluating Ontological Decisions with OntoClean. Communications of the ACM. 45(2):61-65, 2000
11. Tom Heath and Chris Bizer. Linked Data: Evolving the Web into a Global Data Space. Synthesis Lectures on the Semantic Web: Theory and Technology, 2011

Course: Seminar in Enterprise Information Systems [SemAIFB1]

Coordinators: R. Studer, A. Oberweis, T. Wolf, R. Kneuper

Part of the modules: Seminar (p. 109)[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 are able to

- do literature search based on a given topic: identify relevant literature, find, assess and evaluate this literature.
- write the seminar thesis (and later the Bachelor-/Masterthesis) with a minimal learning curve by using format requirements such as those recommended by well-known publishers.
- give presentations in a scientific context in front of an auditorium. These techniques are presented and learned during the seminar.
- present results of the research in written form generally found in scientific publications.

Content

The seminar intensifies and extends specific topics 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>

Literature

Literature will be given individually in the specific seminar.

Course: Seminar Efficient Algorithms [SemAIFB2]

Coordinators: H. Schmeck

Part of the modules: Seminar (p. 109)[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>

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 eOrganization [SemAIFB5]**Coordinators:** S. Tai**Part of the modules:** Seminar (p. [109](#))[MATHMWSEM03]

ECTS Credits	Hours per week	Term	Instruction language
3	2	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

None.

Learning Outcomes

Research in the field of eOrganization adhering to scientific standards.

Content

The seminar explores current research topics of Cloud Service Engineering (including service computing, service engineering, cloud computing and service networks). Each time, a particular focus theme will be chosen.

Course: Seminar in Finance [2530293]

Coordinators: M. Uhrig-Homburg, M. Ruckes
Part of the modules: Seminar (p. [108](#))[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.

Literature

Will be announced at the end of the foregoing semester.

Course: [SemiIWW3]**Coordinators:** I. Ott**Part of the modules:** Seminar (p. 108)[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**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 Development 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 Complexity Management [SemAIFB3]**Coordinators:** D. Seese**Part of the modules:** Seminar (p. [109](#))[MATHMWSEM03]

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

Learning Control / Examinations

see German version

Conditions

None.

Learning Outcomes

see German version

Content

see German version

Literature

Will be announced in the seminar.

Remarks

The number of participants is limited. Please take notice about the inscription procedure at the institutes website. Specific titles and the topics of offered seminars will be announced before the start of a semester on the website of AIFB.

Course: Seminar Service Science, Management & Engineering [2595470]**Coordinators:** C. Weinhardt, R. Studer, S. Nickel, H. Fromm, W. Fichtner**Part of the modules:** Seminar (p. 109)[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

Autonomously deal with a special topic in the Service Science, Management and Engineering field adhering to scientific standards.

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

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. [109](#))[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

In case studies students comprehend stochastic relationships and gain deep knowledge of modelling, evaluation, and optimization of stochastic systems. In group presentations, students learn basic academic presentation and argument skills.

Content

The actual topic as well as the contemporary issues are available online.

Media

Power Point and related presentation techniques.

Literature

Will be presented with the actual topic.

Course: Seminar Knowledge Management [SemAIFB4]

Coordinators: R. Studer

Part of the modules: Seminar (p. 109)[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 Social Computing,
- Business-process Oriented Knowledge Management.

Media

Slides.

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 Insurance Management [SemFBV1]

Coordinators: U. Werner

Part of the modules: Seminar (p. 108)[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 Accounting ? (s.o.)
- Insurance Marketing
- Insurance Production
- Service Management

For their contents refer to the information given for these courses.

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 in Operational Risk Management [SemFBV2]

Coordinators: U. Werner

Part of the modules: Seminar (p. 108)[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* [WW3BWLFBV3] and *Operational Risk Management I/II* [WW4BWLFBV9/10??].

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 module *Risk and Insurance Management* [WW3BWLFBV3] as well as with the master modules *Operational Risk Management I* [WW4BWLFBV8] and *Operational Risk Management II* [MATHMWBWLFBV9]. These modules, though, are not required to be taken.

Learning Outcomes

See German version.

Content

The seminar is offered within the following courses:

- Enterprise Risk Management
- Multidisciplinary Risk Research
- Risk Communication
- Risk Management of Microfinance and Private Households
- Project Work in Risk Research

For their contents refer to the information given for these courses.

Literature

Will be announced at the beginning of the course 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 in Discrete Optimization [2550491]**Coordinators:** S. Nickel**Part of the modules:** Seminar (p. 109)[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 is the weighted average of the marks for the assessed assignments (seminar thesis 30 %, presentation 60%, handout 10%).

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 seminar aims at the presentation, critical evaluation and exemplary discussion of recent questions in discrete optimization. The focus lies on optimization models and algorithms, also with regard to their applicability in practical cases (especially in Supply Chain and Health Care Management).

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 seminar topic.

Regarding the seminar presentations, the students will be familiarized with basic presentational and rhetoric skills.

Content

The topics of the seminar will be announced at the beginning of the term in a preliminary meeting. Dates will be announced on the internet.

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. 108)[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.

Literature

Will be announced at the end of the recess period.

Course: Seminar in Continuous Optimization [2550131]**Coordinators:** O. Stein**Part of the modules:** Seminar (p. 109)[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 scientific 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.

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. [108](#))[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**Content****Literature**

Will be announced at the end of the recess period.

Course: Seminar: Management and Organization [2577915]**Coordinators:** H. Lindstädt**Part of the modules:** Seminar (p. [108](#))[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.

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. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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

Implementation of an own knowledge discovery project. Includes familiarization with, prototypical implementation, experiments and presentation of a topic from the fields of knowledge discovery and data mining adhering to scientific standards.

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 1 [2511500]

Coordinators: S. Tai

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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 (60min.) in the first week after lecture period (nach §4(2), 1 SPO).

Conditions

None.

Recommendations

Lecture A/2 [2511032] is recommended.

Learning Outcomes

The course introduces concepts, methods, and techniques of “service-oriented computing”, including languages for (Web) service description, methods and tools for the development of services, and platforms (middleware, runtimes) for the Web-based deployment, delivery, and execution of services. The course provides a solid technical foundation that enables the student to address the increasingly relevant challenges of developing “service-oriented architectures (SOA)” in the industry.

Content

Web services represent the next-generation of Web technology, and are an evolution of conventional distributed middleware. They enable new and improved ways for enterprise computing, including application interoperability and integration, and business process management. Modern software systems are being designed as service-oriented architectures (SOA), introducing increased agility and flexibility at both the software systems and the business level. Web services and SOA thus have a profound impact on software development and the businesses that they support. The course “Service-oriented Computing” introduces the concepts, methods and technology that provide a solid foundation in this area. Topics include:

- Service description
- Service engineering, including development and implementation
- Service composition (aggregation), including process-based service orchestration
- Interoperability formats and protocols
- Service platforms and runtimes (middleware)

Media

Slides, access to internet resources.

Literature

Will be announced in the lecture.

Course: Service Oriented Computing 2 [2511308]**Coordinators:** R. Studer, S. Agarwal, B. Norton**Part of the modules:** Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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.

Literature

Literature will be announced in the lecture.

Course: Simulation I [2550662]**Coordinators:** K. Waldmann**Part of the modules:** Applications of Operations Research (p. 96)[MATHMWOR5], Stochastic Methods and Simulation (p. 99)[MATHMWOR7], Stochastic Modelling and Optimization (p. 103)[MATHMWOR10]

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

Learning Control / Examinations**Conditions**

Foundations in the following fields are required:

- Operations Research, as lectured in *Introduction to Operations Research I* [2550040] and *Introduction to Operations Research II* [2530043].
- Statistics, as lectured in *Statistics I* [25008/25009] and *Statistics II* [25020/25021].

Learning Outcomes

The lecture provides insights into the typical process in planning and conducting simulation studies.

Content

As the world is getting more complex it is often not possible to analytically provide key figures of interest without overly simplifying the problem. Thus efficient simulation techniques become more and more important. In the lecture important basic concepts are presented in terms of selected case studies.

Topics overview: Discrete event simulation, generation of random numbers, generating discrete and continuous random variables, statistical analysis of simulated data.

Media

Blackboard, Slides, Flash Animations, Simulation Software

Literature

- Lecture Notes
- K.-H. Waldmann / U. M. Stocker: *Stochastische Modelle - Eine anwendungsorientierte Einführung*; Springer (2004).

Elective literature:

- A. M. Law / W. D. Kelton: *Simulation Modeling and Analysis* (3rd ed); McGraw Hill (2000)

Remarks

The lecture is offered irregularly. The curriculum of the next two years is available online.

Course: Simulation II [2550665]**Coordinators:** K. Waldmann**Part of the modules:** Stochastic Modelling and Optimization (p. 103)[MATHMWOR10], Stochastic Methods and Simulation (p. 99)[MATHMWOR7]

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

Learning Control / Examinations**Conditions**

Foundations in the following fields are required:

- Operations Research, as lectured in *Introduction to Operations Research I* [2550040] and *Introduction to Operations Research II* [2530043].
- Statistics, as lectured in *Statistics I* [25008/25009] and *Statistics II* [25020/25021].
- *Simulation I*[2550662]

not any

Learning Outcomes

The lecture provides insights into the typical process in planning and conducting simulation studies.

Content

As the world is getting more complex it is often not possible to analytically provide key figures of interest without overly simplifying the problem. Thus efficient simulation techniques become more and more important. In the lecture important basic concepts are presented in terms of selected case studies.

Topics overview: Variance reduction techniques, simulation of stochastic processes, case studies.

Media

Blackboard, Slides, Flash Animations, Simulation Software

Literature

- Lecture Notes

Elective literature:

- A. M. Law / W. D. Kelton: Simulation Modeling and Analysis (3rd ed); McGraw Hill (2000)
- K.-H. Waldmann / U. M. Stocker: Stochastische Modelle - Eine anwendungsorientierte Einführung; Springer (2004).

Remarks

The lecture is offered irregularly. The curriculum of the next two years is available online.

Course: Software Laboratory: OR Models I [2550490]**Coordinators:** S. Nickel**Part of the modules:** Applications of Operations Research (p. 96)[MATHMWOR5]

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

Firm knowledge of the contents from the lecture *Introduction to Operations Research I* [2550040] of the module *Operations Research* [WI1OR].

Learning Outcomes

The software laboratory has the goal to make the students familiar with the usage of computers in practical applications of Operations Research. An important benefit lies in the ability to assess and estimate general possibilities and fields of usage of modeling and implementation software for solving OR models in practice. As software-based planning modules are used in many companies, this course provides a reasonable preparation for students for practical planning activities.

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.

In the summer term 2013 the lecture is cancelled due to a research semester.

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. 100)[MATHMWOR8], Mathematical Programming (p. 102)[MATHMWOR9]

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

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 course is based on the first part of the software laboratory. The students advance to detailed modelling knowledge and use the software for the implementation of more complex solution methods. An important aspect lies on the practical application possibilities of OR software in 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

In the summer term 2013 the lecture is cancelled due to a research semester.

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

Course: Software Technology: Quality Management [2511208]

Coordinators: A. Oberweis

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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 are familiar with basic concepts and principles of software quality and software quality management. They know key measures and models for certification of quality in software development. They are aware of different test methods and evaluation methods. Furthermore, they are able to assess quality management aspects in different standard process models.

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.

Literature

- Helmut Balzert: Lehrbuch der Software-Technik. Spektrum-Verlag 1998
- Peter Liggesmeyer: Software-Qualität, Testen, Analysieren und Verifizieren von Software. Spektrum Akademischer Verlag 2002

Elective literature:

Further literature is given in lectures.

Course: Spatial Economics [2561260 / 2561261]**Coordinators:** I. Ott**Part of the modules:** Growth and Agglomeration (p. 94)[MATHMWVWL12]

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

Learning Control / Examinations

The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

Conditions

See German version.

Recommendations

See German version.

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

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.

Remarks

Further information can be found on the homepage of the Chair in Economic Policy, wipo.iww.kit.edu

Course: Spectral Theory [SpekTheo]

Coordinators: G. Herzog, C. Schmoeger, R. Schnaubelt, L. Weis

Part of the modules: Spectral Theory (p. 41)[MATHMWAN10]

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.

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

A deepened understanding of functional analytic concepts and methods in the context of spectral theory.

Content

- Closed operators on Banach spaces
- spectrum und resolvent
- compact operators und Fredholm alternative
- Dunford's functional calculus, spectral projections
- Unbounded selfadjoint operators on Hilbert spaces
- Spectral Theorem
- Operators defined by forms
- Applications to partial differential equations

Course: Special Topics of Enterprise Information Systems [SBI]

Coordinators: A. Oberweis

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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

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 are able to handle methods and instruments in a subarea of “Enterprise Information Systems” and to show the capability to be innovative with regard to applied methods.

The course will impart knowledge of basics and methods in the context of their application in practice. Based on the understanding of the imparted concepts and methods students will be able to choose the appropriate methods and apply them in the right way for problems they will face in their professional life.

Students will be enabled to find arguments for solution approaches and to argue for them.

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.

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. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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

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 period wrt (§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.

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 Complexity Management [KompMansp]

Coordinators: D. Seese

Part of the modules: Informatics (p. [104](#))[MATHMWINFO1], Emphasis in Informatics (p. [106](#))[MATHMWINFO2]

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

Learning Control / Examinations

see German version

Conditions

see German version

Learning Outcomes

see German version

Content

see German version

Literature

Elective literature:

Will be announced in the lecture.

Remarks

see German version

Course: Special Topics of Software- and Systemsengineering [SSEsp]

Coordinators: A. Oberweis, D. Seese

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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 are able to handle methods and instruments in a subarea of "Software and Systems Engineering" and to show the capability to be innovative with regard to applied methods.

The course will impart knowledge of basics and methods in the context of their application in practice. Based on the understanding of the imparted concepts and methods students will be able to choose the appropriate methods and apply them in the right way for problems they will face in their professional life.

Students will be enabled to find arguments for solution approaches and to argue for them.

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

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. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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

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 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 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

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. 102)[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.

In a combined examination of *Special Topics in Optimization I* [25128] and *Special Topics in Optimization II* [25126], upon attaining more than 60% of the exercise points, the grade of the passed examination is improved by a third of a grading step.

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 fundamentals of a special topic in continuous optimization.

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. [102](#))[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.

In a combined examination of *Special Topics in Optimization I* [25128] and *Special Topics in Optimization II* [25126], upon attaining more than 60% of the exercise points, the grade of the passed examination is improved by a third of a grading step.

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 fundamentals of a special topic in continuous optimization.

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 Management: Management and IT [2577907]

Coordinators: H. Lindstädt

Part of the modules: Strategic Corporate Management and Organization (p. 90)[MATHMWUO1]

ECTS Credits	Hours per week	Term	Instruction language
2	1/0	Winter / Summer Term	de

Learning Control / Examinations

The assessment consists of a written exam (30 min) at the beginning of the recess period (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.

Conditions

None.

Learning Outcomes

The course discusses management questions and concepts that are clearly motivating from a current and practical perspective. Here the integration of IT and process issues into corporate management from the management's perspective is one of the subjects of particular interest. The event takes place in close cooperation with leading, practical managers.

Content

(Excerpt):

- A summary of current management concepts and questions.

Media

Slides.

Literature

The relevant excerpts and additional sources are made known during the course.

Course: Game Theory [MATHAN13]**Coordinators:** M. Plum, W. Reichel**Part of the modules:** Game Theory (p. [44](#))[MATHMWAN13]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Course: Game Theory I [2520525]**Coordinators:** P. Reiss**Part of the modules:** Decision and Game Theory (p. 92)[MATHMWVWL10]

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

Learning Control / Examinations**Conditions**

None.

Recommendations

Basic knowledge of mathematics and statistics is assumed.

See corresponding module information.

Learning Outcomes

This course conveys established knowledge in theory of strategic decision making. The students shall be able to analyze strategic problems systematically and to give advice for behavior in concrete economic situations.

Content

Main topic is non-cooperative game theory. Models, solution concepts and applications are discussed for simultaneous as well as sequential games. Different equilibrium concepts are introduced and a short introduction to cooperative game theory is given.

Media

Folien, Übungsblätter.

Literature

Gibbons, A primer in Game Theory, Harvester-Wheatsheaf, 1992

Holler/Illing, Eine Einführung in die Spieltheorie, 5. Auflage, Springer Verlag, 2003

Gardner, Games for Business and Economics, 2. Auflage, Wiley, 2003

Berninghaus/Ehrhart/Güth, Strategische Spiele, 2. Auflage, Springer Verlag 2006

Elective literature:

- Binmore, Fun and Games, DC Heath, Lexington, MA, 1991

Course: Stability and Control Theory for Evolution Equations [MATHAN23]**Coordinators:** R. Schnaubelt, L. Weis**Part of the modules:** Stability and Control Theory for Evolution Equations (p. [47](#))[MATHMWAN23]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	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: Operations Research in Supply Chain Management and Health Care Management (p. 100)[MATHMWOR8], Applications of Operations Research (p. 96)[MATHMWOR5], Methodical Foundations of OR (p. 98)[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 successful completion of the online assessments.

Conditions

Prerequisite for admission to examination is the successful completion of the online assessments.

Learning Outcomes

The lecture covers basic quantitative methods in location planning in the context of strategic Supply Chain Planning. Besides the discussion of several criteria for the evaluation of the locations of facilities, the students are acquainted with 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). The exercises accompanying the lecture offer the possibility to apply the considered models to 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.

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

Due to a research semester in the summer term 2013, the lecture will be held in winter term 2013/2014.

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

Course: Statistics [Stat]**Coordinators:** N. Henze, C. Kirch, B. Klar**Part of the modules:** Statistics (p. 67)[MATHWMST05]

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:

Introduction in Stochastics

Learning Outcomes**Content**

Course: Stochastic Calculus and Finance [2521331]

Coordinators: Y. Kim

Part of the modules: Mathematical and Empirical Finance (p. 95)[MATHMWSTAT1]

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

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 will 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.

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. [48](#))[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:** Methodical Foundations of OR (p. 98)[MATHMWOR6], Stochastic Methods and Simulation (p. 99)[MATHMWOR7], Stochastic Modelling and Optimization (p. 103)[MATHMWOR10]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes

The lecture provides students with knowledge of modern techniques of stochastic modelling. Students are able to properly describe and analyze basic stochastic systems.

Content

Markov Chains, Poisson Processes, Markov Chains in Continuous Time, Queuing Systems

Media

Blackboard, Slides, Flash Animations, Simulation Software

Literature

Waldmann, K.H. , Stocker, U.M. (2004): Stochastische Modelle - eine anwendungsorientierte Einführung; Springer

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. 103)[MATHMWOR10], Stochastic Methods and Simulation (p. 99)[MATHMWOR7]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes

The lecture provides students with knowledge on Markov decision processes for analysis to control and optimize stochastic dynamic systems. They are able to apply the theory acquired and to adjust the models to actual problems. They develop the optimality criterion and can solve the resulting optimal value function efficiently to gain optimal policies and the optimal value.

Content

Markov decision models: Foundations, optimality criteria, solution of the optimality equation, optimality of simply structured decision rules, applications.

Media

Blackboard, Slides, Flash Animations, Simulation Software

Literature

Lecture Notes

Elective literature:

Waldmann, K.H. , Stocker, U.M. (2004): Stochastische Modelle - eine anwendungsorientierte Einführung; Springer
 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 Geometry [MATHST06]**Coordinators:** D. Hug, G. Last**Part of the modules:** Stochastic Geometry (p. [68](#))[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: Stochastic control theory [MATHST12]**Coordinators:** N. Bäuerle**Part of the modules:** Control theory of stochastic processes (p. [73](#))[MATHMWST12]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Course: Strategic Brand Management [2571185]**Coordinators:** M. Klarmann, J. Blickhäuser**Part of the modules:** Marketing Management (p. [91](#))[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: Strategic Aspects of Energy Economy [2581958]**Coordinators:** A. Ardone**Part of the modules:** Energy Economics and Technology (p. [89](#))[MATHMWBWLIP5]

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

Learning Control / Examinations

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

Conditions

None.

Learning Outcomes**Content****Literature**

Will be announced in the lecture.

Course: Strategic and Innovative Decision Making in Marketing [2571165]

Coordinators: B. Neibecker

Part of the modules: Marketing Management (p. 91)[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

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 identify 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.

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. Kassarian (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. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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 understand the organization and the content of these functions.

Content

The following topics will be covered: strategic planning of ICT, architecture of ICT, overall planning of ICT, outsourcing, operation and controlling of ICT.

Media

Slides, internet resources

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: Symmetric Spaces [MATHAG19]**Coordinators:** E. Leuzinger**Part of the modules:** Symmetric Spaces (p. [34](#))[MATHMWAG19]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes**Content**

Course: Tactical and Operational Supply Chain Management [2550488]

Coordinators: S. Nickel

Part of the modules: Operations Research in Supply Chain Management and Health Care Management (p. 100)[MATHMWOR8], Stochastic Methods and Simulation (p. 99)[MATHMWOR7], Applications of Operations Research (p. 96)[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 main goal of the lecture is the presentation of fundamental techniques from procurement and distribution logistics. A further aspect is set on methods from inventory management and lot sizing. Students acquire the ability to efficiently utilize quantitative models from transportation planning (long-distance and distribution planning), inventory management and lot sizing in production. The introduced methods will be discussed in more detail and illustrated with case-studies in the accompanying exercises

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.

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 will be held again in summer term 2014.

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. [89](#))[MATHMWBWLIP5]

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**Content**

Course: Theory of Economic Growth [2520543]**Coordinators:** M. Hillebrand**Part of the modules:** Innovation and growth (p. 93)[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.

According to the focus of the course quantitativ-mathematical modelling should be in participant's interest.

Learning Outcomes**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.

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: Management and Strategy [2577900]

Coordinators: H. Lindstädt

Part of the modules: Strategic Corporate Management and Organization (p. 90)[MATHMWUO1]

ECTS Credits	Hours per week	Term	Instruction language
4	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

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.

Content

- Corporate management principles
- Strategic management principles
- Strategic analysis
- Competitive strategy: modelling and selection on a divisional level
- Strategies for oligopolies and networks: anticipation of dependencies
- Corporate strategy: modelling and evaluation on a corporate level
- Strategy implementation

Media

Slides.

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.

Course: Valuation [2530212]**Coordinators:** M. Ruckes**Part of the modules:** Finance 2 (p. 84)[MATHMWBWLFVB2], Finance 3 (p. 85)[MATH4BWLFVB11], Finance 1 (p. 83)[MATHMWBWLFVB1]

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

Learning Control / Examinations**Conditions**

None.

Learning Outcomes

Students learn to assess and compare corporate investment projects from a financial point of view.

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.

Literature**Elective literature:**

Titman/Martin (2007): Valuation – The Art and Science of Corporate Investment Decisions, Addison Wesley.

Course: Calculus of Variations [MATHAN25]**Coordinators:** A. Kirsch, M. Plum, W. Reichel**Part of the modules:** Calculus of Variations (p. [49](#))[MATHMWAN25]

ECTS Credits	Hours per week	Term	Instruction language
8	4/2	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. 91)[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).

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 identify 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 towards 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.

Literature

(Literature is in English and German, see German description)

Course: Heat Economy [2581001]**Coordinators:** W. Fichtner**Part of the modules:** Energy Economics and Technology (p. [89](#))[MATHMWBLIP5]

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**Content****Media**

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

Course: Wavelets [Wave]

Coordinators: A. Rieder

Part of the modules: Wavelets (p. 57)[MATHMWNM14]

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

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

The students get to know the mathematical properties of the integral and discrete wavelet transform. They will be enabled to employ the wavelet transform as an analytic tool in signal- and image-processing.

Content

- windowed (short time) Fourier transform
- integral wavelet transform
- wavelet frames
- wavelet bases
- fast wavelet transform
- construction of orthogonal and bi-orthogonal wavelets
- applications in signal- and image-processing

Course: Seminar Economic Theory [SemWIOR2]**Coordinators:** C. Puppe**Part of the modules:** Seminar (p. [108](#))[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****Content****Literature**

Will be announced at the end of the recess period.

Course: Knowledge Management [2511300]

Coordinators: R. Studer

Part of the modules: Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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

Learning Control / Examinations

Written Examination (60 min) according to §4, Abs. 2, 1 of the examination regulations or oral examination of 20 minutes according to §4, Abs. 2, 2 of the examination regulations. The exam takes place every semester and can be repeated at every regular examination date.

Conditions

Basics in logic, e.g. from lecture Foundations of Informatics 1.

Learning Outcomes

Making students sensitive to the problems of corporate knowledge management, knowledge about the central dimensions of influence as well as of relevant technologies for supporting knowledge management.

Content

In modern companies, knowledge is increasingly important for fulfilling central tasks (such as continuous business process improvement, increasing innovation, increasing customer satisfaction, strategic planning etc). Therefore, knowledge management has become a critical success factor.

The lecture covers different types of knowledge that play a role in knowledge management, the corresponding knowledge processes (generation, capture, access and usage of knowledge) as well as methodologies for the introduction of knowledge management solutions.

The lecture will emphasize computer-based support for knowledge management, such as:

- Ontology-based Knowledge Management
- Communities of Practice, Collaboration Tools, Social Software
- Business-process Oriented Knowledge Management
- Personal Knowledge Management
- Case Based Reasoning (CBR)
- Linked Open Data

Media

Slides and scientific publications as reading material.

Literature

- I. Nonaka, H. Takeuchi: The Knowledge Creating Company. Oxford University Press 1995.
- G. Probst, S. Raub, K. Romhardt: Wissen managen: Wie Unternehmen ihre wertvollste Ressource optimal nutzen. Gabler, Wiesbaden, 5. überarb. Auflage, 2006.
- S. Staab, R. Studer (eds.): Handbook on Ontologies, ISBN 3-540-70999-1, Springer Verlag, 2009.
- A. Back, N. Gronau, K. Tochtermann: Web 2.0 in der Unternehmenspraxis - Grundlagen, Fallstudien und Trends zum Einsatz von Social Software. Oldenbourg Verlag München 2008.
- C. Beierle, G. Kern-Isberner: Methoden wissensbasierter Systeme, Vieweg, Braunschweig/Wiesbaden, 2. überarb. Auflage, 2005

Elective literature:

1. P. Hitzler, M Krötzsch, S. Rudolph, Y. Sure: Semantic Web: Grundlagen, ISBN 3-540-33993-0, Springer Verlag, 2008
2. Abecker, A., Hinkelmann, K., Maus, H., Müller, H.J., (Ed.): Geschäftsprozessorientiertes Wissensmanagement, Mai 2002.VII, 472 S. 70 Abb. Geb. ISBN 3-540-42970-0, Springer Verlag
3. Dieter Fensel. Spinning the Semantic Web. 2003 (ISBN 0262062321).
4. Tim Berners-Lee. Weaving the Web. Harper 1999 geb. 2000 Taschenbuch.

Course: Workflow-Management [2511204]**Coordinators:** A. Oberweis**Part of the modules:** Informatics (p. 104)[MATHMWINFO1], Emphasis in Informatics (p. 106)[MATHMWINFO2]

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 are familiar with the concepts and principles of workflow management concepts and systems and their applications. Based on theoretical foundations they can model business process models. Furthermore they have an overview of further problems of workflow management systems in commercial use.

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.

Literature

- M. Dumas, W. van der Aalst, A. H. ter Hofstede (Hrsg.): *Process Aware Information Systems*. Wiley-Interscience, 2005
- J.F. Chang: *Business Process Management*. Auerbach Publications, 2006

Elective literature:

- W. van der Aalst, H. van Kees: *Workflow Management: Models, Methods and Systems*, Cambridge 2002: The MIT Press
- G. Vossen, J. Becker (Hrsg.): *Geschäftsprozessmodellierung und Workflow-Management. Modelle, Methoden, Werkzeuge*; Int. Thomson Pub. Company, 1996.
- A. Oberweis: *Modellierung und Ausführung von Workflows mit Petri-Netzen*. Teubner-Reihe Wirtschaftsinformatik, B.G. Teubner Verlag, 1996.
- G. Alonso, F. Casati, H. Kuno, V. Machiraju: *Web Services*, 2004, Springer Verlag, Heidelberg 1997
- S. Jablonski, C. Bussler: *Workflow-Management, Modeling Concepts, Architecture and Implementation*, Int. Thomson Computing Press, 1996.

Course: Time Series Analysis [MATHST18]**Coordinators:** N. Henze, C. Kirch, B. Klar**Part of the modules:** Time Series Analysis (p. [78](#))[MATHMWST18]**ECTS Credits**

4

Hours per week

2/1

Term

Summer term

Instruction language**Learning Control / Examinations****Conditions**

None.

Learning Outcomes**Content**



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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.

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Die Universität Karlsruhe (TH) hat sich im Rahmen der Umsetzung des Bolognaprozesses zum Aufbau eines Europäischen Hochschulraumes zum Ziel gesetzt, dass am Abschluss der Studiendenausbildung 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,

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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	<i>nicht bestanden</i> (failed) - es sind Verbesserungen erforderlich, bevor die Leistungen anerkannt werden,
F	<i>nicht bestanden</i> (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)

Amtliche Bekanntmachung

2012

Ausgegeben Karlsruhe, den 24. September 2012

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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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