Karlsruher Institut für Technologie

Industrial Engineering and Management (M.Sc.)

Winter Term 2015/2016
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Department of Economics and Management

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Contents

1 Structure of the Master Programme in Industrial Engineering and Management (M.Sc.)

The master programme in Industrial Engineering and Management (M.Sc.) has 4 terms and consists of 120 credits (CP) including Master's thesis. The master programme further deepens or complements the scientific qualifications acquired in the bachelor programme. The students should be made capable of independently applying scientific knowledge and methods and evaluate their implications and scope concerning solutions of complex scientific and social problems.
Furthermore, the student has to attend two seminars with a minimum of six CP within the seminar module. In addition to the key skills gained in the seminars (3 CP), the student has to acquire additional key skills totalling at least 3 credits.

Industrial Engineering and Management (M.Sc.)										
Semester	Compulsory								Elective	
1 2 3	BA 9 CP	BA 9 CP	EC 9 CP	INFO 9 CP	OR 9 CP	ENG 9 CP	ENG 9 CP	Seminar + KS 6 + 3 CP	Elective 9 CP	Elective 9 CP
4	Master Thesis 30 CP									
	120 CP (8 compulsory modules + 2 elective modules + Master Thesis)									

Figure 1: Structure of the Master Programme (Recommendation)

Figure 1 shows the structure of the subjects and the credits allocated to the subjects. The student has to choose two elective modules of the following disciplines: Business science, economics, informatics, operations research, engineering science, statistics, law and sociology. In principle, both elective modules are also available in one discipline. Thereby it is it is only allowed to choose either one module in law or in sociology.

It is left to the student's individual curriculum (taking into account the examination and module regulations), in which terms the chosen modules will be started and completed. However, it is highly recommended to complete all courses and seminars before beginning the Master's thesis.

2 Key Skills

The master programme Industrial Engineering and Management (M.Sc.) at the Department of Economics and Management distinguishes itself by an exceptionally high level of interdisciplinarity. With the combination of business science, economics, informatics, operations research, mathematics as well as engineering and natural science, the integration of knowledge of different disciplines is an inherent element of the programme. As a result, interdisciplinary and connected thinking is encouraged in a natural way. Furthermore, the seminar courses in the master degree programme contribute significantly to the development of key skills by practicing to elaborate and write scientifically sound papers and presentations about special topics. The *integrative* taught key skills, which are acquired throughout the entire programme, can be classified into the following fields:

Soft skills

1. Team work, social communication and creativity techniques
2. Presentations and presentation techniques
3. Logical and systematical arguing and writing
4. Structured problem solving and communication

Enabling skills

1. Decision making in business context
2. Project management competences
3. Fundamentals of business science
4. English as a foreign language

Orientational knowledge

1. Acquisition of interdisciplinary knowledge
2. Institutional knowledge about economic and legal systems
3. Knowledge about international organisations
4. Media, technology and innovation

The integrative acquisition of key skills especially takes place in several obligatory courses during the master programme, namely

1. Seminar module
2. Mentoring of the Master's thesis
3. Business science, economics and informatics modules

Figure 2 shows the classification of key skills within the master program at a glance.
Besides the integrated key skills, the additive acquisition of key skills, which are totalling at least three credits within the seminar module, is scheduled. Students may choose freely among the offered courses of HoC, ZAK and Sprachenzenrtum.

Art der Schlüsselqualifikation	**Masterstudium**				
	BWL	VWL	INFO	Seminar	Masterarbeit
Basiskompetenzen (soft skills)					
Teamarbeit, soziale Kommunikation und Kreativitätstechniken			**x**		
Präsentationserstellung und -techniken				**x**	
Logisches und systematisches Argumentieren und Schreiben				**x**	**x**
Strukturierte Problemlösung und Kommunikation				**x**	**x**
Praxisorientierung (enabling skills)					
Handlungskompetenz im beruflichen Kontext					**(x)***
Kompetenzen im Projektmanagement					**(x)***
Betriebswirtschaftliche Grundkenntnisse	**x**				
Englisch als Fachsprache	**x**	**x**			
Orientierungswissen					
Interdisziplinäres Wissen	**x**	**x**	**x**	**x**	**(x)***
Institutionelles Wissen über Wirtschafts- und Rechtssysteme		**x**			
Wissen über internationale Organisationen		**x**			
Medien, Technik und Innovation		**x**	**x**		

(x)*.........ist nicht zwingend SQ-vermittelnd; hängt von der Art der Aktivität ab (z.B. Auslandspraktikum, thematische Ausrichtung der Masterarbeit)

Figure 2: Key Skills

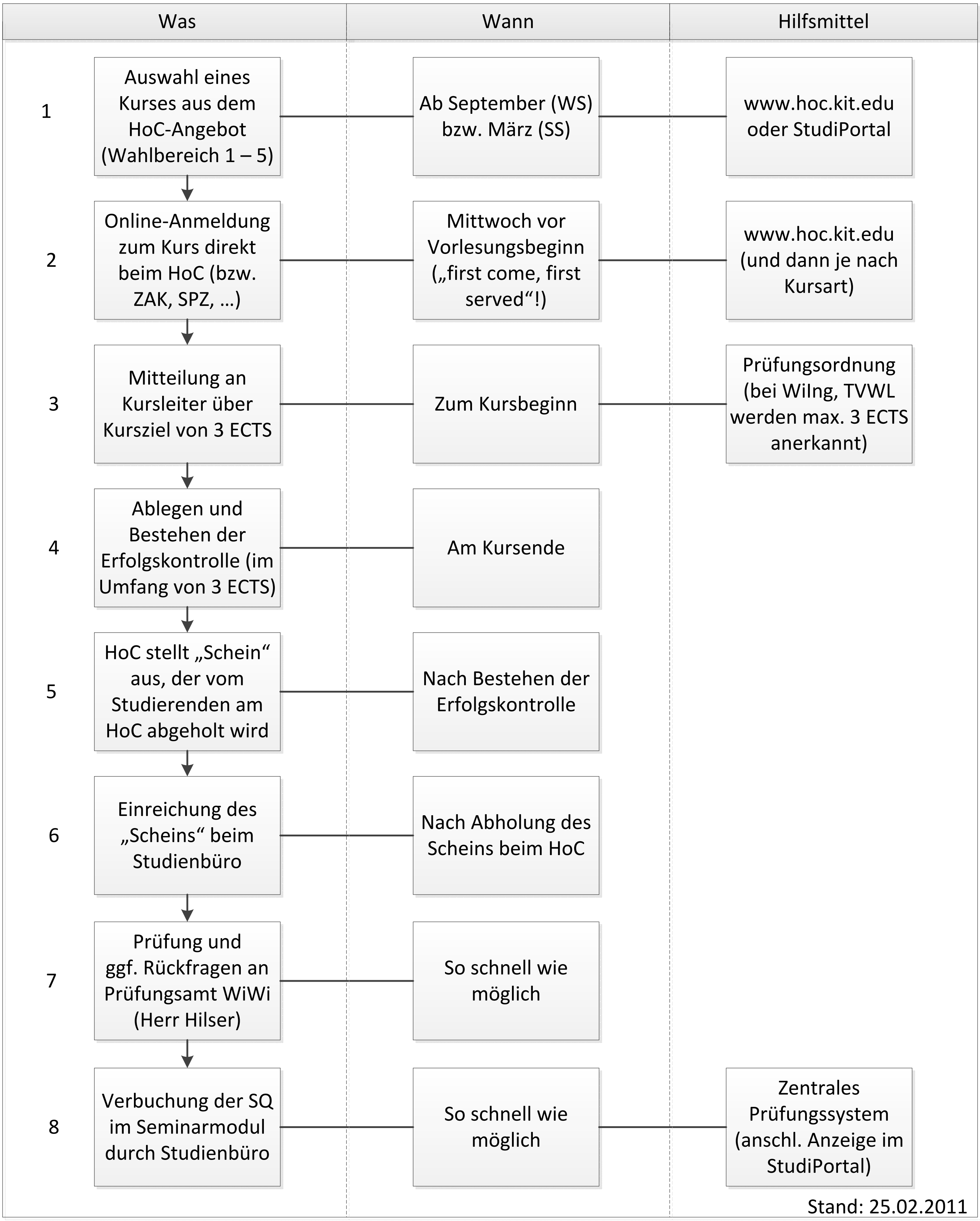

Figure 3: Process of gaining additive key skills

3 Module Handbook - a helpful guide throughout the studies

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. It describes:

- the structure of the modules
- the extent (in CP),
- the dependencies of the modules,
- the learning outcomes,
- the assessment and examinations.

The module hanbook 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 (e.g. if a course is selectable in two or more modules) 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). In order to that the minimum requirement of credits of this module have been met.

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 takes place online via the self-service function for students (https://campus.studium.kit.edu/).

Repeating exams

Principally, a failed exam can repeated only once. If the **repeat examination** (including an eventually provided verbal repeat examination) will be failed as well, the **examination claim** is lost. Requests for a second repetition of an exam require the approval of the examination committee. A request for a second repetition has to be made without delay after loosing the examination claim. A counseling interview is mandatory. For further information see http://www.wiwi.kit.edu/serviceHinweise.php.

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 (in the appendix).

Used abbreviations

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

4 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.

WI4BWLFBV12 - Computational Finance (S. 29)

Anmerkungen

The courses of the module are held in English.
The module will not be offered any more in its old form (Computational Risk and Asset Management [2530371] with 9 credits) from winter term 2015/16. Students who are already assigned on the module can still finish it until winter term 2015/16 (repeaters only).

WI4BWLUO4 - Strategic Decision Making and Organization (S. 34)

Anmerkungen

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

WI4BWLISM3 - Market Engineering (S. 41)

Anmerkungen

The course "Computational Economics" [2590458] will not be offered any more in this module from winter term 2015/2016 on. The examination will be offered latest until summer term 2016 (repeaters only).

WI4BWLIIP2 - Industrial Production II (S. 45)

Anmerkungen

The course "Material Flow Analysis and Life Cycle Assessment [2581995]" will not be offered any more from winter term 2015/16. The examination had been offered latest on July 2015 (repeaters only).
The course "Life Cycle Assessment" will be offered from winter term 2015/16 and replace the course "Material Flow Analysis and Life Cycle Assessment [2581995]".
Apart from the core course the courses offered are recommendations and can be replaced by courses from the Module Industrial Production III.

WI4BWLIIP6 - Industrial Production III (S. 47)

Anmerkungen

The course "The Management of R&D Projects with Case Studies [2581963]" will not be offered any more from summer term 2015. The examination will be offered latest until winter term 2015/16 (repeaters only).
The course "Project Management" will be offered from winter term 2015/16 and replace the course "The Management of R&D Projects with Case Studies [2581963]".
Apart from the core course the courses offered are recommendations and can be replaced by courses from the Module Industrial Production II.

WI4BWLIIP4 - Energy Economics and Energy Markets (S. 49)

Anmerkungen

The course "Basics of Liberalised Energy Markets" [2581998] will be reduced to 3 credits in winter term 2015/2016.

WI4BWLMAR5 - Marketing Management (S. 51)

Bedingungen

Only one of the following courses can be counted towards the final grade of the module:
Marketing Strategy Business Game, Business Plan Workshop, Open Innovation – Concepts, Methods and Best Practices or Strategic Brand Management.
Exception: In summer term 2016 exceptionally two of the courses can be chosen or, in case one course has already been chosen previously, a second course can be chosen.

WI4BWLMAR6 - Sales Management (S. 53)

Bedingungen

The course „Sales Management and Retailing" [2572156] is compulsory and must be passed. This rule only applies to students who take the first examination within the module "Sales Management" after 01.12.2015.

WI4BWLMAR8 - Evidence-based Marketing (S. 55)

Anmerkungen

New module starting winter term 2015/2016.

WI4BWLMAR9 - Services Marketing (S. 56)

Anmerkungen

new module starting winter term 2015/2016

WI4VWL2 - Applied Strategic Decisions (S. 63)

Anmerkungen

The course *Predictive Mechanism and Market Design* is not offered each year.
The course "Decision Theory" [2520365] will not be offered any more from summer term 2015 on. The examination will be offered latest until winter term 2015/2016 (repeaters only).

WI4STAT1 - Mathematical and Empirical Finance (S. 88)

Anmerkungen

This module will not be offered any more from winter term 2015/2016 on.

WI4STAT2 - Statistical Methods in Risk Management (S. 89)

Anmerkungen

This module will not be offered any more from winter term 2015/2016 on.

WI4STAT4 - Analytics and Statistics (S. 90)

Anmerkungen

New module starting winter term 2015/2016.
The planned lectures and courses for the next three years are announced online.

WI4STAT5 - Econometrics and Statistics I (S. 91)

Anmerkungen

New module starting winter term 2015/2016. It replaces the module "Mathematical and Empirical Finance" [WW4STAT1].

WI4STAT6 - Econometrics and Statistics II (S. 92)

Anmerkungen

New module starting winter term 2015/2016. It replaces the module "*Statistical Methods in Risk Management*" [WW4STAT2]

WI4INGMB28 - Logistics in Value Chain Networks (S. 108)

Bedingungen

One of the lectures

- *Logistics – Organization, Design and Control of Logistic Systems* [2118078]
- *Supply Chain Management* [2117062]

is compulsory and must be examined. Also the course *Material flow in logistic systems* is mandatory. In case of combining this module with *Global Production and Logistics* [WW4INGMB31] the course *Material flow in logistic systems* is not compulsory.

WI4INGBGU26 - Public Transportation Operations (S. 137)

Anmerkungen

New module starting summer term 2015.

WI4INGBGU27 - Track Guided Transport Systems / Engineering (S. 138)

Anmerkungen

New module starting summer term 2015.

2530352 - Programming Internship: Solving Computational Risk and Asset Management Problems (S. 480)

Anmerkungen

New course starting winter term 2015/16.

2540450 - Principles of Information Engineering and Management (S. 324)

Erfolgskontrolle

The assessment consists of a written exam (60 min) (according to §4(2), 1 of the examination regulation).

2577904 - Organization Theory (S. 438)

Anmerkungen

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

2540510 - Master Seminar in Information Engineering and Management (S. 388)

Inhalt

The seminar servers on one hand to improve the scientific working skills. On the other hand, the student should work intensively on a given topic and develop a scientific work, that is based on a profound literature research.

The seminar can also be a implementation of software for a scientific problem (e.g. Business Games/dynamic systems) according to the individual focus in the current semester. The software has to be well documented. The written elaboration covers a description and explanation of the software as well as a discussion about limits and extensibility. Furthermore the software must be deployable und shall be presented on the infrastructure stack of the chair. An implementation of a software has to examine the scientific state of the art in a critical way, too.

A concrete description of the current topics is announced in time for the begin of the application stage.

2520317 - Multivariate Statistical Methods (S. 411)

Anmerkungen

The credits for the course “Multivariate Statistical Methods” have been changed from 5 to 4,5 from winter term 2015/2016 on.

2581998 - Basics of Liberalised Energy Markets (S. 190)

Anmerkungen

The course “Basics of Liberalised Energy Markets” [2581998] will be reduced to 3 credits in winter term 2015/2016 and the tutorial [2581999] is no longer offered.

2550493 - Hospital Management (S. 362)

Anmerkungen

The credits have been changed from 3 to 4,5.
The lecture is held in every semester.
The planned lectures and courses for the next three years are announced online.

2550495 - Operations Research in Health Care Management (S. 427)

Anmerkungen

The lecture is planned to be held in the summer term 2016. The planned lectures and courses for the next three years are announced online.

22601 - Chemical Technology of Water (S. 217)

Anmerkungen

The course will not be offered any more from winter term 2014/2015 on. The examination will be offered latest until summer term 2017 (repeaters only).

22612 - Oxidation and Desinfection Processes (S. 439)

Anmerkungen

The course will not be offered any more from summer term 2015 on. The examination will be offered latest until summer term 2017 (repeaters only).

22602 - Excercises in Chemical Technology of Water (S. 641)

Bedingungen

The attendance of the course *Water Technology* is a prerequisite to participate in the exercise.

Anmerkungen

The course will not be offered any more from winter term 2014/2015 on.

2113816 - Vehicle Mechatronics I (S. 276)

Erfolgskontrolle

The assessment will consist of a written exam (90 min) taking place in the recess period (according to §4 (2), 2 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

2550491 - Seminar in Discrete Optimization (S. 552)

Erfolgskontrolle

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

2572156 - Sales Management and Retailing (S. 507)

Bedingungen

This course is compulsory within the module “Sales Management” and must be passed. This rule only applies to students who take the first examination within the module “Sales Management” after 01.12.2015.

SemPÖ1 - Seminar on Morals and Social Behavior (S. 539)

Erfolgskontrolle

Students write a seminar paper on an assigned topic (10 pages), present it in class and discuss results during seminar sessions. These three elements are graded individually. The seminar grade is the weighted average of these individual grades where the weighting is announced on the course syllabus.

2530371 - Computational Risk and Asset Management (S. 223)

Anmerkungen

The course is held in English.
The credits have been changed from 9 to 4,5.

2560240 - Methods in Economic Dynamics (S. 395)

Anmerkungen

The course has been added summer 2015.

2571199 - Open Innovation – Concepts, Methods and Best Practices (S. 426)

Anmerkungen

For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).
Please note that only one of the following courses can be chosen in the Marketing Management Module: Marketing Strategy Business Game, Strategic Brand Management, Open Innovation – Concepts, Methods and Best Practices or Business Plan Workshop.
Exception: In summer term 2016 exceptionally two courses can be chosen or, in case one course has already been chosen previously, a second course can be chosen.
Please note: The number of participants for this course is limited. The Marketing & Sales Research Group typically provides the possibility to attend a course with 1,5 ECTS in the respective module to all students. Participation in a specific course cannot be guaranteed.

2540440 - Marketing Communication (S. 384)

Anmerkungen

New course starting summer term 2015.
The credits for the course have been changed from 3 to 4,5 from summer term 2016 on.

2520357 - Portfolio and Asset Liability Management (S. 459)

Anmerkungen

The credits for the course have been changed from 5 to 4,5 from winter term 2015/2016 on.

2511312 - Web Science (S. 682)

Anmerkungen

New course starting winter term 2015/2016.

n.n. - Project Management (S. 481)

Anmerkungen

The course will be offered from winter term 2015/16 and replace the course “The Management of R&D Projects with Case Studies [2581963]”.

n.n. - Life Cycle Assessment (S. 424)

Anmerkungen

The course will be offered from winter term 2015/16 and replace the course “Material Flow Analysis and Life Cycle Assessment [2581995]”.

2572202 - Services Marketing (S. 572)

Anmerkungen

new course starting summer term 2016

2572200 - Marketing Communication (S. 425)

Anmerkungen

new course starting winter term 2015/2016

2540494 - Regulatory Management and Grid Management - Economic Efficiency of Network Operation (S. 499)

Anmerkungen

New course starting winter term 2015/2016

2550552 - Advanced Statistics (S. 603)

Anmerkungen

New course starting winter term 2015/2016

5 Modules

5.1 Business Administration

Module: Finance 1 [WI4BWLFBV1]

Coordination: M. Uhrig-Homburg, M. Ruckes
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

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. 232)	2/1	S	4,5	M. Uhrig-Homburg
2530212	Valuation (p. 652)	2/1	W	4,5	M. Ruckes
2530555	Asset Pricing (p. 178)	2/1	S	4,5	M. Uhrig-Homburg, M. Ruckes

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

Conditions
None.

Qualification Goals
The student

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

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

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Finance 2 [WI4BWLFBV2]

Coordination: M. Uhrig-Homburg, M. Ruckes
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

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. 282)	2/1	W	4,5	M. Uhrig-Homburg
2530214	Corporate Financial Policy (p. 224)	2/1	S	4,5	M. Ruckes
2530240	Market Microstructure (p. 386)	2/0	W	3	T. Lüdecke
2530565	Credit Risk (p. 363)	2/1	W	4,5	M. Uhrig-Homburg
2530210	Cost and Management Accounting (p. 355)	2/1	S	4,5	T. Lüdecke
2530555	Asset Pricing (p. 178)	2/1	S	4,5	M. Uhrig-Homburg, M. Ruckes
2530212	Valuation (p. 652)	2/1	W	4,5	M. Ruckes
2530550	Derivatives (p. 232)	2/1	S	4,5	M. Uhrig-Homburg
2530570	International Finance (p. 353)	2	S	3	M. Uhrig-Homburg, Dr. Walter
2530299	Business Strategies of Banks (p. 297)	2	W	3	W. Müller
2530296	Exchanges (p. 204)	1	S	1,5	J. Franke
2530232	Financial Intermediation (p. 285)	3	W	4,5	M. Ruckes
2540454	eFinance: Information Engineering and Management for Securities Trading (p. 240)	2/1	W	4,5	C. Weinhardt
2530205	Financial Analysis (p. 283)	2/1	S	4,5	T. Lüdecke

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

Conditions
It is only possible to choose this module in combination with the module *Finance 1* [WI4BWLFBV1]. The module is passed only after the final partial exam of *Finance 1* is additionally passed.

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

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

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
The courses *eFinance: Information Engineering and Management for Securities Trading* [2540454] and *Financial Analysis* [2530205] can be chosen from summer term 2015 on.

Module: Finance 3 [WI4BWLFBV11]

Coordination: M. Uhrig-Homburg, M. Ruckes
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2530555	Asset Pricing (p. 178)	2/1	S	4,5	M. Uhrig-Homburg, M. Ruckes
2530212	Valuation (p. 652)	2/1	W	4,5	M. Ruckes
2530550	Derivatives (p. 232)	2/1	S	4,5	M. Uhrig-Homburg
2530260	Fixed Income Securities (p. 282)	2/1	W	4,5	M. Uhrig-Homburg
2530565	Credit Risk (p. 363)	2/1	W	4,5	M. Uhrig-Homburg
2530214	Corporate Financial Policy (p. 224)	2/1	S	4,5	M. Ruckes
2530240	Market Microstructure (p. 386)	2/0	W	3	T. Lüdecke
2530210	Cost and Management Accounting (p. 355)	2/1	S	4,5	T. Lüdecke
2530232	Financial Intermediation (p. 285)	3	W	4,5	M. Ruckes
2530296	Exchanges (p. 204)	1	S	1,5	J. Franke
2530299	Business Strategies of Banks (p. 297)	2	W	3	W. Müller
2530570	International Finance (p. 353)	2	S	3	M. Uhrig-Homburg, Dr. Walter
2540454	eFinance: Information Engineering and Management for Securities Trading (p. 240)	2/1	W	4,5	C. Weinhardt
2530205	Financial Analysis (p. 283)	2/1	S	4,5	T. Lüdecke

Learning Control / Examinations

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

Conditions

It is only possible to choose this module in combination with the module *Finance 1*[WI4BWLFBV1] and *Finance 2* [WI4BWLFBV2]. The module is passed only after the final partial exams of *Finance 1 and Finance 2* are additionally passed.

Qualification Goals

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

Content

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

Workload

The total workload for this module is approximately 270 hours. For further information see German version.

Remarks

The courses eFinance: Information Engineering and Management for Securities Trading [2540454] and Financial Analysis [2530205] can be chosen from summer term 2015 on.

Module: Computational Finance [WI4BWLFBV12]

Coordination: M. Ulrich
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2530371	Computational Risk and Asset Management (p. 223)	4	W	4,5	M. Ulrich
2530352	Programming Internship: Solving Computational Risk and Asset Management Problems (p. 480)	2	W	4,5	M. Ulrich

Learning Control / Examinations
Successful completion of this module requires the successful completion of the lecture Computational Risk and Asset Management and the programming seminar: Solving Computational Risk and Asset Management Problems.

Conditions
This module is self contained and does not have any pre-requisites. Knowledge of finance is helpful but not a must. All necessary financial, statistical and numerical concepts are introduced during the lecture. The programming seminar focuses on implementing and applying most of the tools to real-world problems. Lecture and programming seminar must be completed in the same semester.

Recommendations
None.

Qualification Goals
The student learns to solve current risk and asset management problems with modern concepts from statistical machine learning, quant finance and numerics. The focus is on understanding the necessary concepts and to apply these during the programming seminar. Upon completion of the module, students will have a conceptional and practical working knowledge of the following concepts:
A) Statistical Machine Learning for predicting asset returns and risk densities
1. 'Supervised learning' with linear models: regression, maximum likelihood, Kalman Filter, VAR, impulse response analysis, causality
2. 'Supervised learning' with non-linear models: NLS, maximum likelihood, non-linear Kalman Filter, expectation maximization
3. Frequency and Bayesian way of estimating 'simple' asset pricing models
4. 'Unsupervised learning': PCA, SVD
B) Financial Concepts
1. CAPM, Fama-French and factor models to predict returns
2. Fama-MacBeth regressions to estimate risk premiums
3. Optimal portfolio allocation (Markowitz)
4. GARCH modeling to predict risk
5. Predicing interest rates
C) Essential numerical tool kit for
1. Determining fixed points
2. Finding roots
3. Simulating random numbers
4. Matrix inversion
5. Solving integrals and differential equations
6. Optimizing functions

Content
This module provides a hands-on introduction to the field of Computational Finance. We will cover methods on how to predict asset returns, how to estimate the risk density of returns and respective risk premiums and how to build optimal portfolios. We will make use of modern statistical machine learning algorithms and test them rigorously with risk and asset management applications. The intuitive, yet analytical combination of machine learning on the one hand and financial applications on the other hand are a key feature of this module.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
The courses of the module are held in English.
The module will not be offered any more in its old form (Computational Risk and Asset Management [2530371] with 9 credits) from winter term 2015/16. Students who are already assigned on the module can still finish it until winter term 2015/16 (repeaters only).

Module: Insurance Management I [WI4BWLFBV6]

Coordination: U. Werner
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

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. 472)	3/0	S	4,5	U. Werner
2530323	Insurance Marketing (p. 347)	3/0	S	4,5	E. Schwake
2530324	Insurance Production (p. 348)	3/0	W/S	4,5	U. Werner
2530050	Private and Social Insurance (p. 473)	2/0	W	2,5	W. Heilmann, K. Besserer
2530350	Current Issues in the Insurance Industry (p. 225)	2/0	S	2	W. Heilmann
2530335	Insurance Risk Management (p. 349)	2/0	S	2,5	H. Maser
INSGAME	P&C Insurance Simulation Game (p. 440)	3	W	3	U. Werner
2530395	Risk Communication (p. 504)	3/0	W/S	4,5	U. Werner
2530355	Modelling, Measuring and Managing of Extreme Risks (p. 406)	2	S	2,5	U. Werner, S. Hochrainer

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

Conditions
None.

Qualification Goals
See German version.

Content
See German version.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Insurance Management II [WI4BWLFBV7]

Coordination: U. Werner
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2530323	Insurance Marketing (p. 347)	3/0	S	4,5	E. Schwake
2530324	Insurance Production (p. 348)	3/0	W/S	4,5	U. Werner
2530050	Private and Social Insurance (p. 473)	2/0	W	2,5	W. Heilmann, K. Besserer
2530350	Current Issues in the Insurance Industry (p. 225)	2/0	S	2	W. Heilmann
2530335	Insurance Risk Management (p. 349)	2/0	S	2,5	H. Maser
2530395	Risk Communication (p. 504)	3/0	W/S	4,5	U. Werner
INSGAME	P&C Insurance Simulation Game (p. 440)	3	W	3	U. Werner
2550055	Principles of Insurance Management (p. 472)	3/0	S	4,5	U. Werner
2530355	Modelling, Measuring and Managing of Extreme Risks (p. 406)	2	S	2,5	U. Werner, S. Hochrainer

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

Conditions
It is only possible to choose this module in combination with the module *Insurance Management I*. The module is passed only after the final partial exam of *Insurance Management I* has been passed.

Recommendations
The courses chosen from the modules Insurance Management I or Insurance Management II are supposed to complement each other. Advice and information is available from the person responsible for the examination process at the Insurance Department of FBV.

Qualification Goals
See German version.

Content
See German version.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
See German version.

Module: Strategic Corporate Management and Organization [WI4BWLUO1]

Coordination: H. Lindstädt
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

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. 438)	2	W	4,5	H. Lindstädt
2577902	Managing Organizations (p. 437)	2/0	W	3.5	H. Lindstädt
2577908	Modeling Strategic Decision Making (p. 404)	2	S	4,5	H. Lindstädt
2577900	Management and Strategy (p. 649)	2/0	S	3.5	H. Lindstädt
2577910	Problem solving, communication and leadership (p. 475)	1/0	S	2	H. Lindstädt

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

Conditions
None.

Qualification Goals
See German version.

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

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

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

Module: Strategic Decision Making and Organization [WI4BWLUO4]

Coordination: H. Lindstädt
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

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. 438)	2	W	4,5	H. Lindstädt
2577908	Modeling Strategic Decision Making (p. 404)	2	S	4,5	H. Lindstädt
2561127	Public Management (p. 485)	2	W	4,5	B. Wigger, Assistenten
2572157	Pricing (p. 471)	2/1	W	4,5	J. Kim

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

Conditions
None.

Qualification Goals
See German version.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

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

Module: Management Accounting [WI4BWLIBU1]

Coordination: M. Wouters
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2579900	Management Accounting 1 (p. 374)	2/2	S	4,5	M. Wouters
2579902	Management Accounting 2 (p. 375)	2/2	W	4,5	M. Wouters

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4 (2), 13 SPO) of the courses of this module. The assessment procedures are described for each course of the module separately.
The overall grade of the module is the average of the grades for each course weighted by the credits
and truncated after the first decimal.

Conditions
None.

Qualification Goals
Students
• are familiar with various management accounting methods,
• can apply these methods for cost estimation, profitability analysis, and product costing,
• are able to analyze short-term and long-decisions with these methods,
• have the capacity to devise instruments for organizational control.

Content
The module consists of two courses “Management Accounting 1“ and “Management Accounting 2”. The emphasis is on structured learning of management accounting techniques.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
Students who like this module are probably also interested in the courses

- 2530216 Financial Management
- 2530210 Management Accounting

Module: Cross-functional Management Accounting [WI4BWLIBU2]

Coordination: M. Wouters
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2579907	Advanced Management Accounting (p. 164)	3	W	4,5	M. Wouters
2572157	Pricing (p. 471)	2/1	W	4,5	J. Kim
2571154	Product and Innovation Marketing (p. 476)	2/0	S	3	M. Klarmann
2571176	Marketing Strategy Business Game (p. 383)	1	S	1,5	M. Klarmann, Mitarbeiter
2530212	Valuation (p. 652)	2/1	W	4,5	M. Ruckes
2577908	Modeling Strategic Decision Making (p. 404)	2	S	4,5	H. Lindstädt

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

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

Conditions
The course “Advanced Management Accounting” is compulsory and must be examined.

Recommendations
None.

Qualification Goals
Students will be able to apply advanced management accounting methods to managerial decision-making problems in marketing, finance, organization and strategy.

Content
The module includes a course on several advanced management accounting methods that can be used for various decisions in operations and innovation management. By selecting another course, each student looks in more detail at one interface between management accounting a particular field in management, namely marketing, finance, or organization and strategy.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Advanced CRM [WI4BWLISM1]

Coordination: A. Geyer-Schulz
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2540508	Customer Relationship Management (p. 226)	2/1	W	4,5	A. Geyer-Schulz
2540506	Recommender Systems (p. 494)	2/1	S	4,5	A. Geyer-Schulz, A. Sonnenbichler
2540533	Personalization and Services (p. 444)	2/1	S	4,5	A. Sonnenbichler
2540518	Social Network Analysis in CRM (p. 584)	2/1	S	4,5	A. Geyer-Schulz
2540531	Business Dynamics (p. 208)	2/1	W	4,5	A. Geyer-Schulz, P. Glenn
2595501	Service Analytics (p. 566)	2/1	S	4,5	T. Setzer, H. Fromm

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

Conditions
None.

Qualification Goals
The student

- understand service competition as a sustainable competitive strategy and understand the effects of service competition on the design of markets, products, processes and services,
- models, analyzes and optimizes the structure and dynamics of complex business applications,
- develops and realizes personalized services, especially in the field of recommendation services,
- analyzes social networks and knows their application field in CRM,
- works in teams.

Content
Besides the foundations of modern customer oriented and service oriented management, developments of CRM systems are lectured together with tools for analysis and optimization of such systems.
An overview of general aspects and concepts of personalization and their importance for service provider and customers is given. Then, different categories of recommendation systems are presented: Ranging from explizit recommendation services like reviews to implicit services like the calcuation of recommendations based on the historic data about products and/or customers.
There exist a trend towards viewing economic systems and social systems as networks. This approach allows for the application of different methods from mathematics, economic sciences, sociology and physics. In CRM, net work analyses may provide benefits calculating customer network values.
CRM processes and marketing campaigns are just two examples of dynamic systems that are characterized by feedback loops between different process steps. By means of the tools of business dynamics such processes can be modelled. Simulations of complex systems allow the analysis and optimization of business processes, marketing campaigns, and organizations.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
The course Social Network Analysis in CRM [2540518] is currently not offered.

The courses *Recommendersystems* and *Personalization and Services* will take place in an alternating way from summer term 14. Details on the cycle and on the exams can be found on http://www.em.uni-karlsruhe.de/studies/.

Module: Electronic Markets [WI4BWLISM2]

Coordination: A. Geyer-Schulz
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2540502	Markets and Organizations: Principles (p. 372)	2/1	W	4,5	A. Geyer-Schulz
2540460	Market Engineering: Information in Institutions (p. 381)	2/1	S	4,5	C. Weinhardt
2561232	Telecommunication and Internet Economics (p. 630)	2/1	W	4,5	K. Mitusch
2540531	Business Dynamics (p. 208)	2/1	W	4,5	A. Geyer-Schulz, P. Glenn
2540500	Business Administration in Information Engineering and Management (p. 211)	2/1	S	5	A. Geyer-Schulz

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

Conditions
None.

Qualification Goals
The student

- knows coordination and motivation methods and analyzes them regarding their efficiency,
- classifies markets and describes the roles of the participants in a formal way,
- knows the conditions for market failure and knows and develops countermeasures,
- knows institutions and market mechanisms, their fundamental theories and empirical research results,
- knows the design criteria of market mechanisms and a systematical approach for creating new markets,
- models, analyzes and optimizes the structure and dynamics of complex business applications.

Content
What are the conditions that make electronic markets develop and how can one analyse and optimize such markets?
In this module, the selection of the type of organization as an optimization of transaction costs is treated. Afterwards, the efficiency of electronic markets (price, information and allocation efficiency) as well as reasons for market failure are described. Finally, motivational issues llike bounded rationality and information assymetries (private information and moral hazard), as well as the development of incentive schemes, are presented. Regarding the market design, especially the interdependencies of market organization, market mechanisms, institutions and products are described and theoretical foundations are lectured.
Electronic markets are dynamic systems that are characterized by feedback loops between many different variables. By means of the tools of business dynamics such markets can be modelled. Simulations of complex systems allow the analysis and optimization of markets, business processes, policies, and organizations.
Topics include:

- classification, analysis, and design of markets
- simulation of markets
- auction methods and auction theory
- automated negotiations
- nonlinear pricing

- continuous double auctions
- market-maker, regulation, control

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
The course *Electronic Marktes: Principles* is not offered at the moment.

Module: Market Engineering [WI4BWLISM3]

Coordination: C. Weinhardt
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2540460	Market Engineering: Information in Institutions (p. 381)	2/1	S	4,5	C. Weinhardt
2520408	Auction Theory (p. 182)	2/1	W	4.5	K. Ehrhart
2540454	eFinance: Information Engineering and Management for Securities Trading (p. 240)	2/1	W	4,5	C. Weinhardt
2540489	Experimental Economics (p. 270)	2/1	W	4,5	C. Weinhardt, T. Teubner
2540464	eEnergy: Markets, Services, Systems (p. 237)	2/1	S	4,5	C. Weinhardt
2540494	Regulatory Management and Grid Management - Economic Efficiency of Network Operation (p. 499)	2/1	W	4,5	S. Rogat

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

Conditions
The course *Market Engineering: Information in Institutions* [2540460] is compulsory and must be examined.

Qualification Goals
The students

- know the design criterias of market mechanisms and the systematic approach to create new markets,
- understand the basics of the mechanism design and auction theory,
- analyze and evaluate existing markets regarding the missing incentives and the optimal solution of a given market mechanism, respectively,
- develop solutions in teams.

Content
This module explains the dependencies between the design von markets and their success. Markets are complex interaction of different institution and participants in a market behave strategically according to the market rules. The development and the design of markets or market mechanisms has a strong influence on the behavior of the participants. A systematic approach and a thorough analysis of existing markets is inevitable to design, create and operate a market place successfully. the approaches for a systematic analysis are explained in the mandatory course *Market Engineering* [2540460] by discussing theories about mechanism design and institutional economics. The student can deepen his knowledge about markets in a second course.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
The course “Computational Economics” [2590458] will not be offered any more in this module from winter term 2015/2016 on. The examination will be offered latest until summer term 2016 (repeaters only).

Module: Business & Service Engineering [WI4BWLISM4]

Coordination: C. Weinhardt
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2540456	Business Models in the Internet: Planning and Implementation (p. 295)	2/1	S	4,5	T. Teubner, R. Knapper
2540498	Special Topics in Information Engineering & Management (p. 588)	3	W/S	4,5	C. Weinhardt
2540506	Recommender Systems (p. 494)	2/1	S	4,5	A. Geyer-Schulz, A. Sonnenbichler
2540533	Personalization and Services (p. 444)	2/1	S	4,5	A. Sonnenbichler
2595468	Service Innovation (p. 570)	2/1	S	4,5	G. Satzger, M. Kohler, N. Feldmann
2595477	Practical Seminar Service Innovation (p. 563)	3		4,5	G. Satzger

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

Conditions
None.

Qualification Goals
The student should

- learn to develop and implement new markets with regards to the technological progresses of information and communication technology and the increasing economic networking
- learn to restructure and develop new business processes in markets under those conditions
- understand service competition as a sustainable competitive strategy and understand the effects of service competition on the design of markets, products, processes and services.
- improve his statistics skills and apply them to appropriate cases
- learn to elaborate solutions in a team

Content
This module addresses the challenges of creating new kinds of products, processes, services, and markets from a service perspective in the context of new developed information and communication technologies and the globalization process. The module describes service competition as a business strategy in the long term that leads to the design of business processes, business models, forms of organization, markets, and competition. This will be shown by actual examples from personalized services, recommender services and social networks.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
All practical Seminars offered at the IM can be chosen for *Special Topics in Information Engineering & Management*. Please update yourself on www.iism.kit.edu/im/lehre .
The courses *Recommendersystems* and *Personalization and Services* will take place in an alternating way from summer term 14. Details on the cycle and on the exams can be found on http://www.em.uni-karlsruhe.de/studies/.

Module: Service Management [WI4BWLISM6]

Coordination: C. Weinhardt, G. Satzger
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2595484	Business and IT Service Management (p. 207)	2/1	W	4,5	G. Satzger
2595468	Service Innovation (p. 570)	2/1	S	4,5	G. Satzger, M. Kohler, N. Feldmann
2595501	Service Analytics (p. 566)	2/1	S	4,5	T. Setzer, H. Fromm
2595505	Industrial Services (p. 336)	2/1	W	4,5	H. Fromm
2540470	Modeling and Analyzing Consumer Behaviour with R (p. 402)	2/1	S	4,5	V. Dorner, C. Weinhardt

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

Conditions
The course *Business and IT Service Management* [2590484] is compulsory and must be examined

Qualification Goals
The students

- understand the basics of developing and managing IT-based services,
- understand and apply OR methods in service management,
- systematically use vast amounts of available data for planning, operation, personalization and improvement of complex service offerings, and
- understand and analyze innovation processes in corporations.

Content
The module service management addresses the basics of developing and managing IT-based services. The lectures contained in this module teach the basics of developing and managing IT-based services and the application of OR methods in the field of service management. Moreover, students learn to systematically analyze vast amounts of data for planning, operation and improvement for complex service offerings. These tools enhance operational and strategic decision support and help to analyze and understand the overall innovation processes in corporations. Current examples from research and industry demonstrate the relevance of the topics discussed in this module.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Information Engineering [WI4BWLISM7]

Coordination: C. Weinhardt
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2540450	Principles of Information Engineering and Management (p. 324)	2/1	W	5	C. Weinhardt, T. Teubner
2540462	Communications Economics (p. 220)	2/1	S	4,5	J. Kraemer
2540460	Market Engineering: Information in Institutions (p. 381)	2/1	S	4,5	C. Weinhardt
2540498	Special Topics in Information Engineering & Management (p. 588)	3	W/S	4,5	C. Weinhardt
2540464	eEnergy: Markets, Services, Systems (p. 237)	2/1	S	4,5	C. Weinhardt

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

Conditions
The course *Principles of Information Engineering and Management* [2540450] is compulsory and must be examined.

Qualification Goals
The student

- understands and analyzes the central role of information as an economic good, a production factor, and a competitive factor,
- identifies, evaluates, prices, and markets information goods,
- analyze and evaluate existing markets regarding the missing incentives and the optimal solution of a given market mechanism, respectively,
- develop solutions in teams.

Content
In the lecture *Principles of Information Engineering and Management*, a clear distinction of information as a production, competitive, and economic good is introduced. The central role of information is explained through the concept of the “information lifecycle”. The single phases from existence/generation through allocation and evaluation until the distribution and usage of information are analyzed from the business administration perspective and the microeconomic perspective.
In a second course the student can deepen his knowledge on the one hand on the design and operation of markets and on the other hand on the impact of digital goods in network industries regarding the pricing policies, business strategies and regulation issues. If choosen, the course Special Topics in Information Engineering & Management additionally provides an opportunity of practical research in the aforementioned range of subjects.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
All practical Seminars offered at the IM can be chosen for *Special Topics in Information Engineering & Management*. Please update yourself on www.iism.kit.edu/im/lehre.

Module: Industrial Production II [WI4BWLIIP2]

Coordination: F. Schultmann
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2581952	Planning and Management of Industrial Plants (p. 172)	2/2	W	5,5	F. Schultmann
2581962	Emissions into the Environment (p. 246)	2/0	W	3,5	U. Karl
2581956	International Management in Engineering and Production (p. 352)	2/0	W	3,5	H. Sasse
n.n.	Life Cycle Assessment (p. 424)	2	W	3,5	H. Keller

Learning Control / Examinations
The assessment is carried out as partial exams (according to section 4 (2), 1 SPO) of the core course *Planning and Managing of Industrial Plants* [2581952] and one further single course of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
The course *Planning and Managing of Industrial Plants* [2581952] and at least one additional activity are compulsory and must be examined.

Recommendations
Skills learned in the compulsory B.Sc. modules of business administration, engineering, operations research and informatics.
The courses are set up in a way that they can be taken independently from each other; therefore it is possible to start this module at any time.
We recommend combining this module with “Industrial Production I” [WW3BWLIIP] (Bachelor) and “Industrial Production III” [WI4BWLIIP6] (Master).

Qualification Goals

- Students shall be able to describe the tasks of tactical production management with special attention drawn upon industrial plants.
- Students shall understand the relevant tasks in plant management (projection, realisation and supervising tools for industrial plants).
- Students shall be able to describe the special need of a techno-economic approach to solve problems in the field of tactical production management.
- Students shall be proficient in using selected techno-economic methods like investment and cost estimates, plant layout, capacity planning, evaluation principles of production techniques, production systems as well as methods to design and optimize production systems.
- Students shall be able to evaluate techno-economical approaches in planning tactical production management with respect to their efficiency, accuracy and relevance for industrial use.

Content

- Planning and Management of Industrial Plants: Basics, circulation flow starting from projecting to techno-economic evaluation, construction and operating up to plant dismantling.

Workload
Total effort will account to 270 hours (9 credit points) and can be allocated according to the credit point rating. Therefore, a course with 3.5 credits requires an effort of approximately 105h and a course with 5.5 credits 165h.
The total effort for each course consists of attending lectures and tutorials, examination times and the time an average student needs to prepare himself in order to pass the exam with an average grade.

Remarks

The course “Material Flow Analysis and Life Cycle Assessment [2581995]” will not be offered any more from winter term 2015/16. The examination had been offered latest on July 2015 (repeaters only).
The course “Life Cycle Assessment” will be offered from winter term 2015/16 and replace the course “Material Flow Analysis and Life Cycle Assessment [2581995]”.
Apart from the core course the courses offered are recommendations and can be replaced by courses from the Module Industrial Production III.

Module: Industrial Production III [WI4BWLIIP6]

Coordination: F. Schultmann
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2581954	Production and Logistics Management (p. 478)	2/2	S	5,5	M. Fröhling
2581961	Supply Chain Management with Advanced Planning Systems (p. 624)	2	S	3,5	M. Göbelt, C. Sürie
2581992	Risk Management in Industrial Supply Networks (p. 505)	2/0	W	3,5	M. Wiens
2581957	Supply Chain Management in the automotive industry (p. 622)	2/0	W	3,5	T. Heupel, H. Lang
n.n.	Project Management (p. 481)	2/1	W	3,5	F. Schultmann

Learning Control / Examinations
The assessment is carried out as partial exams (according to section 4 (2), 1 SPO) of the core course *Production and Logistics Management* [2581954] and further single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
The course *Production and Logistics Management* [2581954] and at least one additional activity are compulsory and must be examined.

Recommendations
The courses are set up in a way that they can be taken independently from each other; therefore it is possible to start this module at any time.
We recommend combining this module with "Industrial Production I" [WW3BWLIIP] (Bachelor) and "Industrial Production II" [WI4BWLIIP2] (Master).
Skills learned in the compulsory B.Sc. modules of business administration, engineering, operations research and informatics.

Qualification Goals

- Students describe the tasks concerning general problems of an operative production and logistics management.
- Students describe the planning tasks of supply chain management.
- Students use proficiently approaches to solve general planning problems.
- Students explain the existing interdependencies between planning tasks and applied methods.
- Students describe the mail goals and set-up of software supporting tools in production and logistics management (i.e. APS, PPS-, ERP- and SCM Systems).
- Students discuss the scope of these software tools and their general disadvantages.

Content

- Planning tasks and exemplary methods of production planning and control in supply chain management.
- Supporting software tools in production and logistics management (APS, PPS- and ERP Systems).
- Project management in the field of production and supply chain management.

Workload
Total effort will account to 270 hours (9 credit points) and can be allocated according to the credit point rating. Therefore, a course with 3.5 credits requires an effort of approximately 105h and a course with 5.5 credits 165h.

The total effort for each course consists of attending lectures and tutorials, examination times and the time an average student needs to prepare himself in order to pass the exam with an average grade.

Remarks

The course “The Management of R&D Projects with Case Studies [2581963]” will not be offered any more from summer term 2015. The examination will be offered latest until winter term 2015/16 (repeaters only).

The course “Project Management” will be offered from winter term 2015/16 and replace the course “The Management of R&D Projects with Case Studies [2581963]”.

Apart from the core course the courses offered are recommendations and can be replaced by courses from the Module Industrial Production II.

Module: Energy Economics and Energy Markets [WI4BWLIIP4]

Coordination: W. Fichtner
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2581998	Basics of Liberalised Energy Markets (p. 190)	2/1	W	3	W. Fichtner
2581020	Energy Trade and Risk Management (p. 254)	3	S	4	W. Fichtner, D. Keles, C. Cremer
2581959	Energy Policy (p. 255)	2/0	S	3,5	M. Wietschel
2581022	Gas-Markets (p. 265)	2/0	W	3	A. Pustisek
2581025	Simulation Game in Energy Economics (p. 448)	2/0	S	3	W. Fichtner
2560234	Regulation Theory and Practice (p. 500)	2/1	S	4,5	K. Mitusch
2540464	eEnergy: Markets, Services, Systems (p. 237)	2/1	S	4,5	C. Weinhardt
2581007	Quantitative Methods in Energy Economics (p. 491)	2/1	W	4	D. Keles, P. Plötz

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

Conditions
The lecture *Basics of Liberalised Energy Markets* [2581998] has to be examined.

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

Qualification Goals
The student

- gains detailed knowledge about the new requirements of liberalised energy markets,
- describes the planning tasks on the different energy markets,
- knows solution approaches to respective planning tasks.

Content
Basics of Liberalised Energy Markets: The European liberalisation process, energy markets, pricing, market failure, investment incentives, market power
Energy Trade and Risk Management: trade centres, trade products, market mechanisms, position and risk management
Gas-Markets: producing countries, provision structures, market places, pricing
Energy Policy: Management of energy flows, energy-political targets and instruments (emission trading etc.)
Simulation Game in Energy Economics: Simulation of the German electricity system

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
The course "Basics of Liberalised Energy Markets" [2581998] will be reduced to 3 credits in winter term 2015/2016.

Module: Energy Economics and Technology [WI4BWLIIP5]

Coordination: W. Fichtner
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

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. 250)	2/1	S	4,5	U. Karl, n.n.
2581958	Strategical Aspects of Energy Economy (p. 614)	2/0	W	3,5	A. Ardone
2581000	Technological Change in Energy Economics (p. 629)	2/0	W	3	M. Wietschel
2581001	Heat Economy (p. 677)	2/0	S	3	W. Fichtner
2581002	Energy Systems Analysis (p. 258)	2/0	W	3	V. Bertsch
2581006	Efficient Energy Systems and Electric Mobility (p. 238)	2/0	S	3,5	R. McKenna, P. Jochem

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

Conditions
None.

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

Qualification Goals
The student

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

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

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Marketing Management [WI4BWLMAR5]

Coordination: M. Klarmann
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2571154	Product and Innovation Marketing (p. 476)	2/0	S	3	M. Klarmann
2571150	Market Research (p. 385)	2/1	S	4,5	M. Klarmann
2572167	Behavioral Approaches in Marketing (p. 662)	2/1	W	4,5	B. Neibecker
2571165	Strategic and Innovative Decision Making in Marketing (p. 615)	2/1	S	4,5	B. Neibecker
2572184	Business Plan Workshop (p. 210)	1	S	3	M. Klarmann, O. Terzidis
2571176	Marketing Strategy Business Game (p. 383)	1	S	1,5	M. Klarmann, Mitarbeiter
2571185	Strategic Brand Management (p. 613)	1/0	S	1,5	M. Klarmann, J. Blickhäuser
2571199	Open Innovation – Concepts, Methods and Best Practices (p. 426)	1/0	S	1,5	A. Hahn
2540440	Marketing Communication (p. 384)	2/1	S	4,5	J. Kim

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
Only one of the following courses can be counted towards the final grade of the module:
Marketing Strategy Business Game, Business Plan Workshop, Open Innovation – Concepts, Methods and Best Practices or Strategic Brand Management.
Exception: In summer term 2016 exceptionally two of the courses can be chosen or, in case one course has already been chosen previously, a second course can be chosen.

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

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

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

- “Business Plan Workshop”
- “Marketing and Strategy Business Game”

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
The course “Open Innovation – Concepts, Methods and Best Practices” [2571199] has been added summer 2015.
For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).

Module: Sales Management [WI4BWLMAR6]

Coordination: M. Klarmann
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2572156	Sales Management and Retailing (p. 507)	2	W	3	M. Klarmann
2572157	Pricing (p. 471)	2/1	W	4,5	J. Kim
2571150	Market Research (p. 385)	2/1	S	4,5	M. Klarmann
2572182	Case Studies in Pricing (p. 215)	1	W	1,5	M. Klarmann, Mitarbeiter
2572198	Price Negotiation and Sales Presentations (p. 470)	1	W	1,5	M. Klarmann, M. Schröder

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
The course „Sales Management and Retailing“ [2572156] is compulsory and must be passed. This rule only applies to students who take the first examination within the module “Sales Management” after 01.12.2015.

Qualification Goals
Students
- have an advanced knowledge about sales management (design and structure of sales systems, relationship with sales partners and important customers)
- have a fundamental understanding of price management (in particular consumer behavior of pricing, pricing strategy, price determination)
- are able to handle particularities and challenges in sales management
- know several qualitative and quantitative approaches to prepare decisions in Marketing
- are able to implement their extensive sales and pricing knowledge in a practical context
- have the theoretical knowledge to write a master thesis in Marketing
- have the theoretical knowledge to work in/together with the sales department

Content
The aim of the module is to deepen the sales management knowledge of the students. Theoretical approaches often have a combined view on marketing and sales, whereas in practical surroundings the sales department is completely separated from the marketing tasks. Given this fact, we concentrate on pure sales management topics and address different facets of the sales management. Students can choose between the following courses:

- “Sales Management and Retailing”
- “Pricing”
- “Market Research” - this course has to be completed successfully by students interested in seminar or master thesis positions at the chair of marketing
- “Case Studies in Pricing”
- “Sales Strategy and Control”

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

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

Module: Strategy, Communication, and Data Analysis [WI4BWLMAR7]

Coordination: B. Neibecker
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2572167	Behavioral Approaches in Marketing (p. 662)	2/1	W	4,5	B. Neibecker
2571165	Strategic and Innovative Decision Making in Marketing (p. 615)	2/1	S	4,5	B. Neibecker
2571162	Information Technology and Business Information (p. 339)	2/1	S	4,5	B. Neibecker
2572157	Pricing (p. 471)	2/1	W	4,5	J. Kim

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
None.

Qualification Goals
Students

- are familiar with general procedures and characteristics to develop new products and services under conditions of market orientation,
- can analyse customer needs, learn to realize competitive advantages and to work out interdisciplinary solutions,
- improve their statistic skills to cope with applied Marketing issues.

Content
The core product is everything a customer or business consumer receives. Marketers must understand what it takes to develop a new product successfully. It is important to understand that innovations differ in their degree of newness (up to radical innovations). This helps to determine how quickly the products will be adopted by a target market. Market orientation is on the front side of the medal, the reverse side includes meeting the needs of diverse stakeholders. To find out the critical drivers of success a deep understanding of analytical and statistical methods is essential. As a result, the developing of an effective marketing strategy is discussed as an empirical, scientific process. In addition, consumer behavior approaches in marketing are discussed as an important research area with a strong interdisciplinary and empirical orientation.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

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

Module: Evidence-based Marketing [WI4BWLMAR8]

Coordination: M. Klarmann
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2571150	Market Research (p. 385)	2/1	S	4,5	M. Klarmann
2572170	Marketing Analytics (p. 382)	2/1	W	4,5	M. Klarmann

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 rst decimal.

Conditions
In order to attend Marketing Analytics [2572170], students are required to have passed the course Market Research [2571150].

Qualification Goals
Students

- possess advanced knowledge of relevant market research contents
- know many different qualitative and quantitative methods for measuring customer behavior, preparation of strategic decisions, making causal deductions, usage of social media data and sales forecasting
- possess the statistical skills required for working in marketing research

Content
This module provides in-depth knowledge of relevant quantitative and qualitative methods used in market research.
Students can attend the following courses:

- The course "**Market Research**" provides contents of practical relevance for measuring customer attitudes and customer behavior. The participants learn using statistical methods for strategic decision-making in marketing. Students who are interested in writing their master thesis at the Marketing & Sales Research Group are required to take this course.
- The course „**Marketing Analytics**" is based on „Market Research" and teaches advanced statistical methods for analyzing relevant marketing and market research questions.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
New module starting winter term 2015/2016.

Module: Services Marketing [WI4BWLMAR9]

Coordination: J. Kim
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2572202	Services Marketing (p. 572)	2	S	3	J. Kim
2572200	Marketing Communication (p. 425)	2/1	W	4,5	J. Kim
2540440	Marketing Communication (p. 384)	2/1	S	4,5	J. Kim
2572157	Pricing (p. 471)	2/1	W	4,5	J. Kim
2572182	Case Studies in Pricing (p. 215)	1	W	1,5	M. Klarmann, Mitarbeiter

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 rst decimal.

Conditions
None.

Qualification Goals
Students

- gain knowledge about basic content and strategies of services marketing
- know about current topics (research and practice) in online marketing and learn how the transparency of the internet provides new opportunities to measure the success of marketing instruments
- get to know marketing communications objectives and strategies
- have a fundamental understanding of price management (in particular consumer behavior of pricing, pricing strategy, price determination)
- are able to implement their extensive sales and pricing knowledge in a practical context
- are able to implement their extensive marketing knowledge in a practical context
- have the knowledge to write a master thesis in Services Marketing

Content
understanding of services marketing. Besides the classical offline services, the module also focuses on online services. The course “Services Marketing” starts with an overview of basic content and strategies in services marketing.
Within the course “Online Marketing” students learn about current topics (research and practice) in online marketing and learn how the transparency of the internet provides new opportunities to measure the success of marketing instruments.
In “Marketingkommunikation” students learn about marketing communication objectives and strategies.
The course “Pricing” builds a fundamental understanding of price management.
In the course “Case Studies in Sales and Pricing“ students work with case studies helping them to understand the bridge between theoretical and practical knowledge.

Workload

Remarks
new module starting winter term 2015/2016

Module: Entrepreneurship (EnTechnon) [WI4BWLENT1]

Coordination: O. Terzidis
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2545001	Entrepreneurship (p. 261)	2	W/S	3	O. Terzidis
2545010	Design Thinking (p. 233)	2	W/S	3	O. Terzidis, Dr. Kneisel, Dr. H. Haller, P. Nitschke
2545005	Business Planning (p. 296)	2	W/S	3	O. Terzidis, Mitarbeiter des Lehrstuhls
2545012	Entrepreneurial Leadership & Innovation Management (p. 260)	2	W	3	O. Terzidis, C. Linz
2545003	Managing New Technologies (p. 377)	2/1	S	5	T. Reiß
2572184	Business Plan Workshop (p. 210)	1	S	3	M. Klarmann, O. Terzidis
2545015	Innovation Management: Concepts, Strategies and Methods (p. 345)	2	S	3	M. Weissenberger-Eibl
2540456	Business Models in the Internet: Planning and Implementation (p. 295)	2/1	S	4,5	T. Teubner, R. Knapper
2513305	Developing Business Models for the Semantic Web (p. 234)	2	W	3	R. Studer, M. Maleshkova, F. Keppmann
2545019	Case studies seminar: Innovation management (p. 278)	2	W	3	M. Weissenberger-Eibl
2545016	Roadmapping (p. 506)	2	S	3	D. Koch
2545002	Entrepreneurship Research (p. 262)	2	S	3	O. Terzidis, Mitarbeiter

Learning Control / Examinations
See German version.

Conditions
None.

Qualification Goals
See German version.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Innovation Management [WI4BWLENT2]

Coordination: M. Weissenberger-Eibl
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2545015	Innovation Management: Concepts, Strategies and Methods (p. 345)	2	S	3	M. Weissenberger-Eibl
2545016	Roadmapping (p. 506)	2	S	3	D. Koch
2545017	Technology Assessment (p. 627)	2	S	3	D. Koch
2545018	Technologies for Innovation Management (p. 628)	2	W	3	D. Koch
2545019	Case studies seminar: Innovation management (p. 278)	2	W	3	M. Weissenberger-Eibl
2545018	Current issues in Innovation Management (p. 167)	2	W/S	3	M. Weissenberger-Eibl
2545001	Entrepreneurship (p. 261)	2	W/S	3	O. Terzidis
2545010	Design Thinking (p. 233)	2	W/S	3	O. Terzidis, Dr. Kneisel, Dr. H. Haller, P. Nitschke
2545012	Entrepreneurial Leadership & Innovation Management (p. 260)	2	W	3	O. Terzidis, C. Linz

Learning Control / Examinations
See German version.

Conditions
The lecture “Innovation Management: Concepts, Strategies and Methods” and one of the seminars of the chair for Innovation and Technology Management are compulsory. The second seminar can be chosen from the courses of the module.

Recommendations
None.

Qualification Goals
Students develop a comprehensive understanding of the innovation process and its conditionality. There is an additional focus on the concepts and processes which are of particular relevance with regard to shaping the entire process. Various strategies and methods are then taught based on this.
After completing the module, students should have developed a systemic understanding of the innovation process and be able to shape this by developing and applying suitable methods.

Content
The Innovation Management: Concepts, Strategies and Methods lecture course teaches concepts, strategies and methods which help students to form a systemic understanding of the innovation process and how to shape it. Building on this holistic understanding, the seminar courses then go into the subjects in greater depth and address specific processes and methods which are central to innovation management.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Service Analytics [WI4BWLKSR1]

Coordination: H. Fromm, C. Weinhardt
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2595501	Service Analytics (p. 566)	2/1	S	4,5	T. Setzer, H. Fromm
2595505	Industrial Services (p. 336)	2/1	W	4,5	H. Fromm
2540498	Special Topics in Information Engineering & Management (p. 588)	3	W/S	4,5	C. Weinhardt
2540470	Modeling and Analyzing Consumer Behaviour with R (p. 402)	2/1	S	4,5	V. Dorner, C. Weinhardt
2540498	Service Analytics II – Enterprise Data Reduction and Prediction (p. 568)	2/1	S	4,5	T. Setzer, C. Weinhardt

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

Conditions
The course Service Analytics [2595501] is compulsory and must be examined.

Recommendations
Basic knowledge of Operations Research, Descriptive Statistics, and Inferential Statistics is assumed.

Qualification Goals
The student should learn to

- Understand different scenarios where analytics is applied in a service context
- Distinguish different analytics methods and concepts and learn when to apply them
- Apply analytics tools in a service context
- Analyze and solve real-world business problems through leveraging analytics

Content
Modern economies have turned into “servitized” economies – with almost 70% of the gross value added being derived from the tertiary sector and with an increasing number of industrial companies proceeding to engage in service-type offerings. The adoption of analytics applied to services for leveraging the full potential of big data is still in its infancy - some areas like web analytics are more advanced, some other areas are just starting. This module strives to provide an overview on analytics methods applied in a service context and introduces different scenarios where analytics is applied to improve different kinds of services. The module offers the opportunity to apply and deepen this knowledge in hands-on tutorials and seminars.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
Starting summer term 2015, the lecture “Service Analytics II – Enterprise Data Reduction and Prediction” [2540498] can be chosen in the module.

Module: Service Design Thinking [WI4BWLKSR2]

Coordination: C. Weinhardt, G. Satzger
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2595600	Service Design Thinking (p. 569)	6	W/S	9	C. Weinhardt

Learning Control / Examinations
The assessment is carried out as a general exam (according to Section 4(2), 3 of the examination regulation). The overall grade of the module is the grade of the examination (according to Section 4(2), 3 of the examination regulation).

Conditions
The course Service Design Thinking is compulsory and must be examined.

Recommendations
This course is held in English – proficiency in writing and communication is required.

Qualification Goals

- Deep knowledge of the innovation method "Design Thinking", as introduced and promoted by Stanford University
- Development of new, creative solutions through extensive observation of oneself and one's environment, in particular with regard to the relevant service users
- Know how to use prototyping and experimentation to visualize one's ideas, to test and iteratively develop them, and to converge on a solution
- Communicate, work and present in an interdisciplinary and international project setting

Content

- Paper Bike: Learning about the basic method elements by building a paper bike that has to fulfill a given set of challenges.
- Design Space Exploration: Exploring the problem space through customer and user observation.
- Critical Function Prototype: Identification of critical features from the customer's perspective that can contribute to the solution of the overarching problem. Building and testing prototypes that integrate these functionalities.
- Dark Horse Prototype: Inverting earlier assumptions and experiences, which leads to the inclusion of new features and solutions.
- Funky Prototype: Integration of the individually tested and successful functions to a complete solution, which is further tested and developed.
- Functional Prototype: Further selection and convergence of existing ideas. Building a higher resolution prototype that can be tested by customers.
- Final Prototype: Preparing and presenting the final solution to the customer.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
Due to the project nature of the course, the number of participants is limited. For further information see the course description.

Module: Real Estate Economics and Sustainability [WI4BWLÖÖW1]

Coordination: D. Lorenz
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Business Administration

ECTS Credits	Cycle	Duration
9	Every 2nd term, Winter Term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2586407	Real Estate Economics and Sustainability Part 1: Basics and Valuation (p. 334)	2/1	W	4,5	D. Lorenz
2585406	Real Estate Economics and Sustainability Part 2: Reporting and Rating (p. 335)	2/1	S	4,5	D. Lorenz

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 examination for the courses generally consist of a 60 minute written exam. A 20 minute oral exam is only offered after the second failure of the written exam. The exams for the respective parts (Part 1: Basics and Valuation and Part 2: Reporting and Rating) happen in the same semester in which the lectures take place.
Therefore, Part I currently only takes place in the winter semester and Part II takes place in the summer semester. In each semester there are two alternative dates for the exam and exams can be re-sat at any regular exam date.
The overall grade of the module is the average of the grades of each course weighted by the credits and truncated after the first decimal.
It is possible to include the grade of a seminar paper, dealing with a topic from the area of Real Estate Economics and Sustainability, into the final grade of the module (according to Section 4(2), 3 of the examination regulation). The seminar has a weight of 20 percent.

Conditions
None.

Recommendations
A combination with courses in the area of
• Finance
• Insurance
• Civil engineering and architecture
is recommended.
Particularly recommended is the successful completion of the following Bachelor-Modules:
- Real Estate Management I and II
- Design, Construction and Assessment of Green Buildings I and II

Qualification Goals
The student

- possesses an overview of key interrelationships within the real estate industry concerning macro- and microeconomic questions as well as the interaction of the industry's key players;
- is aware of the basics concerning the sustainable development debate and knows about the possible contribution of buildings and the real estate industry to a more sustainable development;
- knows the basics, key methods and tools of property valuation and is able to apply them;
- is aware of the key influencing factors of a building's market value and is able to factor in sustainability considerations into market value estimates;
- possess an overview of important other methods and processes – besides property valuation – which are applied within the real estate industry to assess property related risks (e.g. property ratings) and to communicate property performance towards third parties (e.g. sustainability assessment of buildings and sustainability reporting of companies).

Content

The implementation of sustainable development principles within the real estate industry requires taking into account sustainability considerations within real estate related procedures and decision making processes. Within this context, property valuation and valuation professionals play an important role.

Property valuations are carried out in almost any phase of the building life cycle and support, for example, financing as well as by and sell decisions.

Valuation methods and procedures, however, have to be adjusted to changing market participants' preferences and their willingness to pay. For this reason, the issue of "valuation and sustainability" is of particular topicality and relevance.

Within the real estate industry professionals are sought which combine micro- and macroeconomic knowledge and real estate specific expertise with knowledge and skills regarding the sustainability of buildings and building stocks.

The real estate industry offers attractive working and career opportunities. This teaching module / course therefore offers insights into key methods applied within the real estate industry (particularly valuation) and places them into the context of sustainable development. The focus of the module / course, however, is not only on theoretical content but also on the provisioning of linkages to real estate practice; this will be realized, amongst other issues, by practical tutorials which are offered in addition to the course lectures.

Workload

The total workload for this module is approximately 270 hours. For further information see German version.

Remarks

See German version.

5.2 Economics

Module: Applied Strategic Decisions [WI4VWL2]

Coordination: P. Reiss
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: 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)
2521533	Advanced Game Theory (p. 163)	2/1	W	4,5	P. Reiss, C. Puppe, K. Ehrhart
2520408	Auction Theory (p. 182)	2/1	W	4.5	K. Ehrhart
2540460	Market Engineering: Information in Institutions (p. 381)	2/1	S	4,5	C. Weinhardt
2540489	Experimental Economics (p. 270)	2/1	W	4,5	C. Weinhardt, T. Teubner
2520402	Predictive Mechanism and Market Design (p. 469)	2/1	W	4,5	P. Reiss
2530214	Corporate Financial Policy (p. 224)	2/1	S	4,5	M. Ruckes
2530232	Financial Intermediation (p. 285)	3	W	4,5	M. Ruckes

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

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

Conditions
The course *Advanced Game Theory* is obligatory. Exception: The course *Introduction to Game Theory* [2520525] was completed.

Recommendations
Basic knowledge in game theory is assumed.

Qualification Goals
Students

- can model and analyze complex situations of strategic interaction using advanced game theoretic concepts;
- are provided with essential and advanced game theoretic solution concepts on a rigorous level and can apply them to understand real-life problems;
- learn about the experimental method, ranging from designing an economic experiment to data analysis.

Content
The module provides solid skills in game theory and offers a broad range of game theoretic applications. To improve the understanding of theoretical concepts, it pays attention to empirical evidence as well.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
The course *Predictive Mechanism and Market Design* is not offered each year.
The course “Decision Theory” [2520365] will not be offered any more from summer term 2015 on. The examination will be offered latest until winter term 2015/2016 (repeaters only).

Module: Economic Policy II [WI4VWL3]

Coordination: J. Kowalski
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: 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)
2561257	Economic integration in Europe (p. 268)	2/1	W	4,5	J. Kowalski
2560236	Innovationtheory and -policy (p. 346)	2/1	S	4,5	I. Ott
2560254	International Economic Policy (p. 354)	2/1	S	4,5	J. Kowalski

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

Conditions
None.

Qualification Goals

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Network Economics [WI4VWL4]

Coordination: K. Mitusch
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: 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)
2561204	Competition in Networks (p. 685)	2/1	W	4,5	K. Mitusch
2560234	Regulation Theory and Practice (p. 500)	2/1	S	4,5	K. Mitusch
2560230	Transport Economics (p. 638)	2/1	S	4,5	G. Liedtke, E. Szimba
2561232	Telecommunication and Internet Economics (p. 630)	2/1	W	4,5	K. Mitusch
2520527	Advanced Topics in Economic Theory (p. 165)	2/1	S	4,5	M. Hillebrand, K. Mitusch

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

Conditions
In this module the lecture *Competition in Networks* [2561204] (Prof. Mitusch) has to be attended and the test passed, unless it has been passed during the Bachelor studies.

Recommendations
Basics of microeconomics obtained within the undergraduate programme (B.Sc) of economics are required. Useful, but not necessary, are basic knowledge of industrial economics, prinicpal agent theory, and contract theory.

Qualification Goals
The students

- have acquired the basic knowledge for a future job in a network company or in a regulatory agency, ministry etc.
- recognize the specific characterizations of network sectors, know fundamental methods for an economic analysis of network sectors and recognize the interfaces for an interdisciplinary cooperation of economists, engineers and lawyers
- understand the interactions between infrastructures, control systems, and the users of networks, especially concerning their implications on investments, price setting and competitive behavior, and they can model or simulate exemplary applications
- can assess the necessity of regulation of natural monopolies and identify regulatory measures that are important for networks.

Content
The module is concerned with network or infrastructure industries in the economy, e.g. telecommunication, traffic and energy sectors. These sectors are characterized by close interdependencies of operators and users of infrastructure as well as on states. States intervene in various forms, by the public and regulation authorities, due to the importance of network industries and due to limited abilities of markets to work properly in these industries. The students are supposed to develop a broad knowledge of these sectors and of the political options available.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Environmental Economics [WI4VWL5]

Coordination: K. Mitusch
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: 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)
2521547	Environmental Economics and Sustainability (p. 646)	2/1	W	5	R. Walz
2560548	Environmental and Ressource Policy (p. 643)	2	S	4	R. Walz
2581003	Energy and Environment (p. 250)	2/1	S	4,5	U. Karl, n.n.
24140	Environmental Law (p. 647)	2	W	3	G. Sydow
2560230	Transport Economics (p. 638)	2/1	S	4,5	G. Liedtke, E. Szimba

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

Conditions
None.

Recommendations
Knowledge in the area of microeconomics and of the content of the course *Economics I: Microeconomics* [2600012], respectively, is required.

Qualification Goals
The students

- understand the treatment of non-market resources as well as future resource shortages
- are able to model markets of energy and environmental goods
- are able to assess the results of government intervention
- know legal basics and are able to evaluate conflicts with regard to legal situation

Content
Environmental degradation and increasing resource use are global challenges, which have to be tackled on a worldwide level. The module addresses these challenges from the perspective of economics, and imparts the fundamental knowledge of environmental and sustainability economics, and environmental and resource policy to the students. Additional courses address environmental law, environmental pressure, and applications to the transport sector.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Macroeconomic Theory [WI4VWL8]

Coordination: M. Hillebrand
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: 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. 634)	2/1	S	4,5	M. Hillebrand
25549	Theory of Business Cycles (p. 633)	2/1	W	4,5	M. Hillebrand
2561503	Theory of endogenous growth (p. 249)	2/1	W	4,5	I. Ott

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

Conditions
None.

Recommendations
Grundlegende mikro- und makroökonomische Kenntnisse, wie sie beispielsweise in den Veranstaltungen *Volkswirtschaftslehre I (Mikroökonomie)* [2600012] und *Volkswirtschaftslehre II (Makroökonomie)* [2600014] vermittelt werden, werden vorausgesetzt. Aufgrund der inhaltlichen Ausrichtung der Veranstaltung wird ein Interesse an quantitativ-mathematischer Modellierung vorausgesetzt.

Qualification Goals
See German version.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Transport infrastructure policy and regional development [WI4VWL11]

Coordination: K. Mitusch
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: 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)
2560230	Transport Economics (p. 638)	2/1	S	4,5	G. Liedtke, E. Szimba
2561260	Spatial Economics (p. 586)	2/1	W	4,5	I. Ott

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

Conditions
None.

Qualification Goals
The students

- understand the economic issues related to transport and regional development with a main focus on economic policy issues generated by the relationship of transport and regional development with the public sector
- are able to compare different considerations of politics, regulation and the private sector and to analyse and assess the respective decision problems both qualitatively and by applying appropriate methods from economic theory
- are prepared for careers in the public sector, particularly for public companies, politics, regulatory agencies, related consultancies, mayor construction companies or infrastructure project corporations

Content
The development infrastructure (e.g. transport, energy, telecommunications) has always been one of the most relevant factors for economic development and particularly influences the development of the regional economy. From the repertoire of state actions, investments into transport infrastructure are often regarded the most important measure to foster regional economic growth. Besides the direct effects of transport policy on passenger and freight transport, a variety of individual economic activities is significantly dependent on the available or potential transport options. Decisions on the planning, financing and realization of mayor infrastructure projects require a solid and far-reaching consideration of direct and indirect growth effects with the occurring costs.
Through its combination of lectures the module reflects the complex interdependencies between infrastructure policy, transport industry and regional policy and provides its participants with a comprehensive understanding of the functionalities of one of the most important sectors of the economy and its relevance for economic policy.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
The courses *Assessment of Public Policies and Projects I* (winter term) and *Assessment of Public Policies and Projects II* (summer term) will no longer be part of this module. Student who have already had exams in this courses can integrate these exams in this module.

Module: Growth and Agglomeration [WI4VWL12]

Coordination: I. Ott
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Economics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2561503	Theory of endogenous growth (p. 249)	2/1	W	4,5	I. Ott
2561260	Spatial Economics (p. 586)	2/1	W	4,5	I. Ott
2560254	International Economic Policy (p. 354)	2/1	S	4,5	J. Kowalski

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

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

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

Qualification Goals
The student

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

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

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Agglomeration and Innovation [WI4VWL13]

Coordination: I. Ott
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: 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)
2561260	Spatial Economics (p. 586)	2/1	W	4,5	I. Ott
2560236	Innovationtheory and -policy (p. 346)	2/1	S	4,5	I. Ott
2520527	Advanced Topics in Economic Theory (p. 165)	2/1	S	4,5	M. Hillebrand, K. Mitusch

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 add up to at least 9.
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.

Qualification Goals
The student

- applies quantitative methods in the context of economic models
- learns advanced micro- and macroeconomic theories
- is able to derive policy recommendations based on theory
- can identify the importance of alternative incentive mechanisms for the development and spread of innovations
- begins to understand the connections between market form and the development of innovations
- analyzes the determinants of the spatial distribution of economic activity
- understands how processes of concentration result from the interplay of agglomeration and dispersion forces

Content
The module comprises theories of incentives for the development of innovations as well as theories of wage-based labor mobility, which leads to spatial concentration processes. The microfounded optimality decisions of the actors are in each case transformed into macroeconomic results. In the context of the theory of innovations the diffusion of technological knowledge and the resulting effect on growth due to technological progress is discussed and economic-policy implications are derived. Spatial economics adds to the picture of economic activity by introducing a spatial point of view.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Economic Theory and its Application in Finance [WI4VWL14]

Coordination: K. Mitusch
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Economics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2520527	Advanced Topics in Economic Theory (p. 165)	2/1	S	4,5	M. Hillebrand, K. Mitusch
2530214	Corporate Financial Policy (p. 224)	2/1	S	4,5	M. Ruckes
2530232	Financial Intermediation (p. 285)	3	W	4,5	M. Ruckes
2530555	Asset Pricing (p. 178)	2/1	S	4,5	M. Uhrig-Homburg, M. Ruckes

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

Conditions
The course „Advanced Topics in Economic Theory“ is compulsory and must be examined.
It is only possible to choose this module in the Elective Programme.

Recommendations
None.

Qualification Goals
The students

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

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

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Microeconomic Theory [WI4VWL15]

Coordination: C. Puppe
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Economics

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2521533	Advanced Game Theory (p. 163)	2/1	W	4,5	P. Reiss, C. Puppe, K. Ehrhart
2520527	Advanced Topics in Economic Theory (p. 165)	2/1	S	4,5	M. Hillebrand, K. Mitusch
2520537	Social Choice Theory (p. 581)	2/1	S	4,5	C. Puppe
2520408	Auction Theory (p. 182)	2/1	W	4.5	K. Ehrhart

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

Conditions
None.

Recommendations
None.

Qualification Goals
Students

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

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

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

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
Starting summer term 2015, the lecture “Auction Theory” [2520408] can be chosen in the module.

Module: Collective Decision Making [WI4VWL16]

Coordination: C. Puppe
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: 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)
2525537	Mathematical Theory of Democracy (p. 392)	2/1	W	4,5	A. Melik-Tangyan
2520537	Social Choice Theory (p. 581)	2/1	S	4,5	C. Puppe
2561127	Public Management (p. 485)	2	W	4,5	B. Wigger, Assistenten

Learning Control / Examinations

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

Conditions

None.

Recommendations

None.

Qualification Goals

Students

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

Content

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

Workload

The total workload for this module is approximately 270 hours. For further information see German version.

Module: Experimental Economics [WI4VWL17]

Coordination: P. Reiss
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Economics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2540489	Experimental Economics (p. 270)	2/1	W	4,5	C. Weinhardt, T. Teubner
2520402	Predictive Mechanism and Market Design (p. 469)	2/1	W	4,5	P. Reiss
2520400	Topics in Experimental Economics (p. 637)	2/1	S	4,5	P. Reiss

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

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

Conditions
The course *Experimental Economics* [2540489] is compulsory and must be examined.

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

Qualification Goals
Students

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

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

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks

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

Module: Innovation and growth [WI4VWLIWW1]

Coordination: I. Ott
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Economics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2520543	Theory of Economic Growth (p. 634)	2/1	S	4,5	M. Hillebrand
2560236	Innovationtheory and -policy (p. 346)	2/1	S	4,5	I. Ott
2561503	Theory of endogenous growth (p. 249)	2/1	W	4,5	I. Ott

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

Conditions
None.

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

Qualification Goals
Students shall be given the ability to

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

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

Workload
Total expenditure of time for 9 credits: 270 hours

Attendance time per lecture: 3x14h

Preparation and wrap-up time per lecture: 3x14h

Rest: Exam Preparation

The exact distribution is subject to the credits of the courses of the module.

Module: Advanced Topics in Public Finance [WI4VWL18]

Coordination: B. Wigger
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: 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)
2561127	Public Management (p. 485)	2	W	4,5	B. Wigger, Assistenten
2560120	Public Revenues (p. 422)	2/1	S	4,5	B. Wigger, Assistenten
2560129	Specific Aspects in Taxation (p. 596)	3	W	4,5	B. Wigger, Armin Bader

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

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

Conditions
The course “Public Management” is compulsory and must be examined.

Recommendations
Basic knowledge in the area of public finance and public management is required.

Qualification Goals
The student

- understands the theory and politics of taxation
- has knowledge in the area of public debt.
- understands efficiency problems of public organizations.
- is able to work on fiscal problems.

Content
As a branch of Economics, Public Finance is concerned with the theory and policy of the public sector and its interrelations with the private sector. It analyzes the economic role of the state from a normative as well as from a positive point of view. The normative view examines efficiency- and equity-oriented motives for government intervention and develops fiscal policy guidelines. The positive view explains the actual behavior of economic agents in public sector affairs.
In the course of the lectures within this module the students achieve knowledge in the areas of public revenues, national and international law of taxation and theory of public sector organizations.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
Students who successfully passed the exam in „Public Management“ before the introduction of the module “Advanced Topics in Public Finance” in winter term 2014/15 are allowed to take both courses “Public Revenues” and “Specific Aspects in Taxation”.

Module: [WI4VWL19]

Coordination: I. Ott
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: 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)
2560236	Innovationtheory and -policy (p. 346)	2/1	S	4,5	I. Ott
2571154	Product and Innovation Marketing (p. 476)	2/0	S	3	M. Klarmann
SemIWW3	Seminar in Economic Policy (p. 534)	2	W/S	3	I. Ott
2560240	Methods in Economic Dynamics (p. 395)	1/0	S	1.5	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 examinations are offered every semester. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module seperately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions

None.

Recommendations

Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012] and Economics II [2600014]. Further, it is assumed that students have interest in using quantiative-mathematical methods.

Qualification Goals

Students shall be given the ability to

- understand the important role of innovation for economic growth and welfare
- understand the relevance of alternative incentive mechanisms for the emergence and dissemination of innovations
- know basic terms of product and innovation concepts
- know fundamental concepts of innovation management
- work with fundamental theoretical innovation models and to implement them in appropriate computer algebra systems
- query appropriate data sources and to analyse and visualise them using statistical methods

Content

The module provides students with knowledge about implications of technological and organizational changes.
Addressed economic issues are incentives for developing innovations, diffusion processes, and associated effects. In this context the module analyses appropriate policies in the presence of market failures to take corrective action on the market process and thus to increase the dynamic efficiency of economies.
Furthermore, the module offers the possibility to learn about different aspects of theoretical modelling of innovation-based growth as a part of the seminar and the methods-workshop. This includes the implementation of formal models in computer algebra systems as well as recording, processing and econometric analysis of related data from relational databases (concerning for example patents or trademarks). Moreover, methods of network theory are applied.
Finally, the module emphasises the business perspective: Issues of all stages of innovation processes will be discussed, from innovation strategies up to the market commercialisation.

Workload

The total workload for this module is approximately 270 hours. For further information see German version.

Remarks

This module has been added summer 2015.

5.3 Informatics

Module: Informatics [WI4INFO1]

Coordination: H. Schmeck, A. Oberweis, R. Studer
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: 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. 168)	2/1	W	5	H. Schmeck
2511032	Applied Informatics II - IT Systems for e-Commerce (p. 170)	2/1/1	S	5	J. Zöllner, N.N.
2511202	Database Systems and XML (p. 230)	2/1	W	5	A. Oberweis
2511212	Document Management and Groupware Systems (p. 235)	2	S	4	S. Klink
2511100	Efficient Algorithms (p. 239)	2/1	S	5	H. Schmeck
2511600	Enterprise Architecture Management (p. 259)	2/1	W	5	T. Wolf
2511404	IT Complexity in Practice (p. 379)	2/1	W	5	D. Seese, Kreidler
2511302	Knowledge Discovery (p. 360)	2/1	W	5	R. Studer
2511214	Management of IT-Projects (p. 378)	2/1	S	5	R. Schätzle
2511210	Business Process Modelling (p. 405)	2/1	W	5	A. Oberweis
2511106	Nature-inspired Optimisation Methods (p. 415)	2/1	S	5	P. Shukla
2511104	Organic Computing (p. 435)	2/1	S	5	H. Schmeck
2590458	Computational Economics (p. 222)	2/1	W	4,5	P. Shukla, S. Caton
2511216	Capability maturity models for software and systems engineering (p. 655)	2	S	4	R. Kneuper
2511308	Service Oriented Computing 2 (p. 571)	2/1	S	5	R. Studer, S. Agarwal, B. Norton
2511208	Software Quality Management (p. 583)	2/1	S	5	A. Oberweis
25700sp	Special Topics of Efficient Algorithms (p. 590)	2/1	W/S	5	H. Schmeck
SBI	Special Topics of Enterprise Information Systems (p. 589)	2/1	W/S	5	A. Oberweis
SSEsp	Special Topics of Software- and Systemsengineering (p. 591)	2/1	W/S	5	A. Oberweis
25860sem	Special Topics of Knowledge Management (p. 592)	2/1	W/S	5	R. Studer
2511602	Strategic Management of Information Technology (p. 617)	2/1	S	5	T. Wolf
2511204	Workflow-Management (p. 689)	2/1	S	5	A. Oberweis
25810	Practical Seminar Knowledge Discovery (p. 562)	2	S	4	R. Studer
PraBI	Computing Lab Information Systems (p. 464)	2	W/S	4	A. Oberweis, R. Studer
25700p	Advanced Lab in Efficient Algorithms (p. 465)	3	W/S	4	H. Schmeck
25740p	Exercises in Knowlegde Management (p. 466)	3	W/S	4	R. Studer
2511218	Requirements Analysis and Requirements Management (p. 169)	2/0	W	4	R. Kneuper
2511310	Semantic Web Technologies (p. 516)	2/1	S	5	R. Studer, A. Harth
2511108	Smart Energy Distribution (p. 580)	2	S	4	H. Schmeck
2511312	Web Science (p. 682)	2/1	W	5	Y. Sure-Vetter

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

Conditions
It is only allowed to choose one lab.

Qualification Goals
The student

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

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

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Emphasis in Informatics [WI4INFO2]

Coordination: H. Schmeck, A. Oberweis, R. Studer
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: 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. 168)	2/1	W	5	H. Schmeck
2511032	Applied Informatics II - IT Systems for e-Commerce (p. 170)	2/1/1	S	5	J. Zöllner, N.N.
2511202	Database Systems and XML (p. 230)	2/1	W	5	A. Oberweis
2511212	Document Management and Groupware Systems (p. 235)	2	S	4	S. Klink
2511100	Efficient Algorithms (p. 239)	2/1	S	5	H. Schmeck
2511600	Enterprise Architecture Management (p. 259)	2/1	W	5	T. Wolf
2511404	IT Complexity in Practice (p. 379)	2/1	W	5	D. Seese, Kreidler
2511302	Knowledge Discovery (p. 360)	2/1	W	5	R. Studer
2511214	Management of IT-Projects (p. 378)	2/1	S	5	R. Schätzle
2511210	Business Process Modelling (p. 405)	2/1	W	5	A. Oberweis
2511106	Nature-inspired Optimisation Methods (p. 415)	2/1	S	5	P. Shukla
2511104	Organic Computing (p. 435)	2/1	S	5	H. Schmeck
2590458	Computational Economics (p. 222)	2/1	W	4,5	P. Shukla, S. Caton
2511216	Capability maturity models for software and systems engineering (p. 655)	2	S	4	R. Kneuper
2511308	Service Oriented Computing 2 (p. 571)	2/1	S	5	R. Studer, S. Agarwal, B. Norton
2511208	Software Quality Management (p. 583)	2/1	S	5	A. Oberweis
SBI	Special Topics of Enterprise Information Systems (p. 589)	2/1	W/S	5	A. Oberweis
25700sp	Special Topics of Efficient Algorithms (p. 590)	2/1	W/S	5	H. Schmeck
SSEsp	Special Topics of Software- and Systemsengineering (p. 591)	2/1	W/S	5	A. Oberweis
25860sem	Special Topics of Knowledge Management (p. 592)	2/1	W/S	5	R. Studer
2511602	Strategic Management of Information Technology (p. 617)	2/1	S	5	T. Wolf
2511204	Workflow-Management (p. 689)	2/1	S	5	A. Oberweis
PraBI	Computing Lab Information Systems (p. 464)	2	W/S	4	A. Oberweis, R. Studer
25700p	Advanced Lab in Efficient Algorithms (p. 465)	3	W/S	4	H. Schmeck
25810	Practical Seminar Knowledge Discovery (p. 562)	2	S	4	R. Studer
25740p	Exercises in Knowlegde Management (p. 466)	3	W/S	4	R. Studer
2511218	Requirements Analysis and Requirements Management (p. 169)	2/0	W	4	R. Kneuper
2511506	Business Activity Management (p. 206)	2/1	S	5	C. Janiesch
2511310	Semantic Web Technologies (p. 516)	2/1	S	5	R. Studer, A. Harth
2511108	Smart Energy Distribution (p. 580)	2	S	4	H. Schmeck
2511312	Web Science (p. 682)	2/1	W	5	Y. Sure-Vetter

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
It is only allowed to choose one lab.

Qualification Goals
The student

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

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

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Electives in Informatics [WI4INFO3]

Coordination: H. Schmeck, A. Oberweis, R. Studer
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: 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. 168)	2/1	W	5	H. Schmeck
2511032	Applied Informatics II - IT Systems for e-Commerce (p. 170)	2/1/1	S	5	J. Zöllner, N.N.
2511202	Database Systems and XML (p. 230)	2/1	W	5	A. Oberweis
2511212	Document Management and Groupware Systems (p. 235)	2	S	4	S. Klink
2511100	Efficient Algorithms (p. 239)	2/1	S	5	H. Schmeck
2511600	Enterprise Architecture Management (p. 259)	2/1	W	5	T. Wolf
2511404	IT Complexity in Practice (p. 379)	2/1	W	5	D. Seese, Kreidler
2511302	Knowledge Discovery (p. 360)	2/1	W	5	R. Studer
2511214	Management of IT-Projects (p. 378)	2/1	S	5	R. Schätzle
2511210	Business Process Modelling (p. 405)	2/1	W	5	A. Oberweis
2511106	Nature-inspired Optimisation Methods (p. 415)	2/1	S	5	P. Shukla
2511104	Organic Computing (p. 435)	2/1	S	5	H. Schmeck
2590458	Computational Economics (p. 222)	2/1	W	4,5	P. Shukla, S. Caton
2511216	Capability maturity models for software and systems engineering (p. 655)	2	S	4	R. Kneuper
2511308	Service Oriented Computing 2 (p. 571)	2/1	S	5	R. Studer, S. Agarwal, B. Norton
2511208	Software Quality Management (p. 583)	2/1	S	5	A. Oberweis
SBI	Special Topics of Enterprise Information Systems (p. 589)	2/1	W/S	5	A. Oberweis
25700sp	Special Topics of Efficient Algorithms (p. 590)	2/1	W/S	5	H. Schmeck
SSEsp	Special Topics of Software- and Systemsengineering (p. 591)	2/1	W/S	5	A. Oberweis
25860sem	Special Topics of Knowledge Management (p. 592)	2/1	W/S	5	R. Studer
2511602	Strategic Management of Information Technology (p. 617)	2/1	S	5	T. Wolf
2511204	Workflow-Management (p. 689)	2/1	S	5	A. Oberweis
PraBI	Computing Lab Information Systems (p. 464)	2	W/S	4	A. Oberweis, R. Studer
25700p	Advanced Lab in Efficient Algorithms (p. 465)	3	W/S	4	H. Schmeck
25810	Practical Seminar Knowledge Discovery (p. 562)	2	S	4	R. Studer
25740p	Exercises in Knowlegde Management (p. 466)	3	W/S	4	R. Studer
2511218	Requirements Analysis and Requirements Management (p. 169)	2/0	W	4	R. Kneuper
2511506	Business Activity Management (p. 206)	2/1	S	5	C. Janiesch
2511310	Semantic Web Technologies (p. 516)	2/1	S	5	R. Studer, A. Harth
2511108	Smart Energy Distribution (p. 580)	2	S	4	H. Schmeck
2511312	Web Science (p. 682)	2/1	W	5	Y. Sure-Vetter

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 separately.
When every singled examination is passed, the overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
It is only allowed to choose one lab.

Recommendations
Knowledge of the content of the module *Emphasis in Informatics* [WI4INFO2] is helpful.

Qualification Goals
The student

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

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

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

5.4 Operations Research

Module: Operations Research in Supply Chain Management and Health Care Management [WI4OR5]

Coordination: S. Nickel
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Operations Research

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. 599)	2/1	W	4,5	S. Nickel
2550488	Tactical and Operational Supply Chain Management (p. 626)	2/1	S	4,5	S. Nickel
2550480	Operations Research in Supply Chain Management (p. 428)	2/1	W/S	4,5	S. Nickel
2550495	Operations Research in Health Care Management (p. 427)	2/1	W/S	4,5	S. Nickel
2550493	Hospital Management (p. 362)	3/0	W/S	4,5	S. Nickel, Hansis
2550498	Practical seminar: Health Care Management (with Case Studies) (p. 468)	2/1/2	W/S	7	S. Nickel
2550497	Software Laboratory: OR Models II (p. 582)	2/1	S	4,5	S. Nickel
2550488	Discrete-event Simulation in Production and Logistics (p. 267)	2/1	S	4,5	S. Nickel, S. Spieckermann
2550494	Supply Chain Management in the Process Industry (p. 623)	2/1	W	4,5	S. Nickel
2550484	Graph Theory and Advanced Location Models (p. 303)	2/1	W/S	4,5	S. Nickel
2550494	Challenges in Supply Chain Management (p. 216)	3	S	4,5	R. Blackburn

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

Conditions
See German version.

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

Qualification Goals
The student

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

Content

Supply Chain Management is concerned with the planning and optimization of the entire, inter-company procurement, production and distribution process for several products taking place between different business partners (suppliers, logistics service providers, dealers). The main goal is to minimize the overall costs while taking into account several constraints including the satisfaction of customer demands.

This module considers several areas of SCM. On the one hand, the determination of optimal locations within a supply chain is addressed. Strategic decisions concerning the location of facilities as production plants, distribution centers or warehouses are of high importance for the rentability of Supply Chains. Thoroughly carried out, location planning tasks allow an efficient flow of materials and lead to lower costs and increased customer service. On the other hand, the planning of material transport in the context of supply chain management represents another focus of this module. By linking transport connections and different facilities, the material source (production plant) is connected with the material sink (customer). For given material flows or shipments, it is considered how to choose the optimal (in terms of minimal costs) distribution and transportation chain from the set of possible logistics chains, which asserts the compliance of delivery times and further constraints. Furthermore, this module offers the possibility to learn about different aspects of the tactical and operational planning level in Suppy Chain Mangement, including methods of scheduling as well as different approaches in procurement and distribution logistics. Finally, issues of warehousing and inventory management will be discussed.

Health Care Management addresses specific Supply Chain Management problems in the health sector. Important applications arise in scheduling and internal logistics of hospitals.

Workload

Total effort for 9 credits: ca. 270 hours

- Presence time: 84 hours
- Preparation/Wrap-up: 112 hours
- Examination and examination preparation: 74 hours

Remarks

Some lectures and courses are offered irregularly.

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

Module: Mathematical Programming [WI4OR6]

Coordination: O. Stein
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Operations Research

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2550138	Mixed Integer Programming I (p. 291)	2/1	S	4,5	O. Stein
25140	Mixed Integer Programming II (p. 292)	2/1	W	4,5	O. Stein
2550128	Special Topics in Optimization I (p. 593)	2/1	W/S	4,5	O. Stein
2550126	Special Topics in Optimization II (p. 594)	2/1	W/S	4,5	O. Stein
2550484	Graph Theory and Advanced Location Models (p. 303)	2/1	W/S	4,5	S. Nickel
2550111	Nonlinear Optimization I (p. 420)	2/1	S	4,5	O. Stein
2550113	Nonlinear Optimization II (p. 421)	2/1	S	4,5	O. Stein
2550134	Global Optimization I (p. 299)	2/1	W	4,5	O. Stein
2550136	Global Optimization II (p. 300)	2/1	W	4,5	O. Stein
2550120	Convex Analysis (p. 361)	2/1		4,5	O. Stein
2550115	Parametric Optimization (p. 442)	2/1		4,5	O. Stein

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

Conditions
See German version.

Qualification Goals
The student

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

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

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

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 [WI4OR7]

Coordination: K. Waldmann
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Operations Research

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. 609)	2/1/2	W	5	K. Waldmann
2550682	Markov Decision Models II (p. 610)	2/1/2	S	4,5	K. Waldmann
2550674	Quality Control I (p. 488)	2/1/2	W/S	4,5	K. Waldmann
2550659	Quality Control II (p. 489)	2/1/2	W/S	4,5	K. Waldmann
25687	Optimization in a Random Environment (p. 432)	2/1/2	W/S	4,5	K. Waldmann
2550662	Simulation I (p. 577)	2/1/2	W/S	4,5	K. Waldmann
2550665	Simulation II (p. 578)	2/1/2	W/S	4,5	K. Waldmann
25688	OR-oriented modeling and analysis of real problems (project) (p. 434)	2/1/2	W/S	4,5	K. Waldmann

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

Conditions
See German version.

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

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

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

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

5.5 Statistics

Module: Mathematical and Empirical Finance [WI4STAT1]

Coordination: W. Heller, M. Schienle
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Statistics

ECTS Credits	Cycle	Duration
9	Irregular	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2521331	Stochastic Calculus and Finance (p. 608)	2/1	W	4,5	M. Safarian
2520381	Advanced Econometrics of Financial Markets (p. 162)	2/1	S	5	A. Nazemi
2521353	Statistical Methods in Financial Risk Management (p. 601)	2/1		4,5	A. Nazemi
2520357	Portfolio and Asset Liability Management (p. 459)	2/1	S	4,5	M. Safarian
2520020	Applied Econometrics (p. 171)	2/1	S	4,5	M. Schienle

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

Conditions
None.

Qualification Goals
See German version.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
This module will not be offered any more from winter term 2015/2016 on.

Module: Statistical Methods in Risk Management [WI4STAT2]

Coordination: W. Heller, M. Schienle
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Statistics

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2520375	Data Mining and Applications (p. 228)	2	S	4,5	G. Nakhaeizadeh
2520317	Multivariate Statistical Methods (p. 411)	2/2	S	4,5	O. Grothe
2521353	Statistical Methods in Financial Risk Management (p. 601)	2/1		4,5	A. Nazemi
2521325/2521326	Statistics and Econometrics in Business and Economics (p. 602)	2/2	W	4,5	W. Heller
2520357	Portfolio and Asset Liability Management (p. 459)	2/1	S	4,5	M. Safarian
2520020	Applied Econometrics (p. 171)	2/1	S	4,5	M. Schienle

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

Conditions
None.

Qualification Goals
See German version.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
This module will not be offered any more from winter term 2015/2016 on.

Module: Analytics and Statistics [WI4STAT4]

Coordination: O. Grothe
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Statistics

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2520317	Multivariate Statistical Methods (p. 411)	2/2	S	4,5	O. Grothe
2550552	Advanced Statistics (p. 603)	2/2	W	4,5	O. Grothe

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

Conditions
The course "*Advanced Statistics*" is compulsory and must be examined.

Qualification Goals
A Student

- Deepens the knowledge of descriptive and inferential statistics.
- Deals with simulation methods.
- Learns basic and advanced methods of statistical analysis of multivariate and high-dimensional data.

Content

- Deriving estimates and testing hypotheses
- Stochastic processes
- Multivariate statistics, copulas
- Dependence measures
- Dimension reduction
- High-dimensional methods
- Prediction

Workload
The total workload for this module is approximately 270 hours.

Remarks
New module starting winter term 2015/2016.
The planned lectures and courses for the next three years are announced online.

Module: Econometrics and Statistics I [WI4STAT5]

Coordination: M. Schienle
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Statistics

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2520020	Applied Econometrics (p. 171)	2/1	S	4,5	M. Schienle
2520022	Financial Econometrics (p. 284)	2/2	W	4,5	M. Schienle
2521300	Non- and Semiparametrics (p. 419)	2/2	W	4,5	M. Schienle
2520320	(p. 441)	2/2	S	4,5	W. Heller
2521350	Statistical Modeling of generalized regression models (p. 604)	2/2	W	4,5	W. Heller
2520375	Data Mining and Applications (p. 228)	2	S	4,5	G. Nakhaeizadeh

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

Conditions
The course “*Advanced Statistics*” [2520020] is compulsory and must be examined.

Qualification Goals
The student shows an in depth understanding of advanced Econometric techniques suitable for different types of data.He/She is able to apply his/her theoretical knowledge to real world problems with the help of statistical software and to evaluate performance of different approaches based on statistical criteria.

Content
The courses of this module offer students a broad range of advanced Econometric techniques for state-of-the art data analysis.

Workload
The total workload for this module is approximately 270 hours.

Remarks
New module starting winter term 2015/2016. It replaces the module “Mathematical and Empirical Finance” [WI4STAT1].

Module: Econometrics and Statistics II [WI4STAT6]

Coordination: M. Schienle
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Statistics

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2520375	Data Mining and Applications (p. 228)	2	S	4,5	G. Nakhaeizadeh
2520317	Multivariate Statistical Methods (p. 411)	2/2	S	4,5	O. Grothe
2520357	Portfolio and Asset Liability Management (p. 459)	2/1	S	4,5	M. Safarian
2521331	Stochastic Calculus and Finance (p. 608)	2/1	W	4,5	M. Safarian
2520020	Applied Econometrics (p. 171)	2/1	S	4,5	M. Schienle
2520022	Financial Econometrics (p. 284)	2/2	W	4,5	M. Schienle
2520320	(p. 441)	2/2	S	4,5	W. Heller
2521350	Statistical Modeling of generalized regression models (p. 604)	2/2	W	4,5	W. Heller
2521300	Non- and Semiparametrics (p. 419)	2/2	W	4,5	M. Schienle

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

Conditions
This module can only be passed if the module *"Econometrics and Statistics I"* [WI4STAT5] has been finished successfully before.

Qualification Goals
The student shows an in depth understanding of advanced Econometric techniques suitable for different types of data. He/She is able to apply his/her theoretical knowledge to real world problems with the help of statistical software and to evaluate performance of different approaches based on statistical criteria.

Content
This modula builds on prerequisites acquired in Module *"Econometrics and Statistics I"*. The courses of this module offer students a broad range of advanced Econometric techniques for state-of-the art data analysis.

Workload

Remarks
New module starting winter term 2015/2016. It replaces the module "*Statistical Methods in Risk Management*" [WI4STAT2]

5.6 Engineering Sciences

Module: Automotive Engineering [WI4INGMB5]

Coordination: F. Gauterin
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2113805	Automotive Engineering I (p. 305)	4	W	6	F. Gauterin, H. Unrau
2114835	Automotive Engineering II (p. 306)	2	S	3	F. Gauterin, H. Unrau
2115817	Project Workshop: Automotive Engineering (p. 482)	3	W/S	4,5	F. Gauterin, M. Gießler, M. Frey
2113814	Fundamentals for Design of Motor-Vehicles Bodies I (p. 318)	1	W	1,5	H. Bardehle
2114840	Fundamentals for Design of Motor-Vehicles Bodies II (p. 319)	1	S	1,5	H. Bardehle
2114093	Fluid Technology (p. 286)	2	W	5	M. Geimer, M. Scherer
2114092	BUS-Controls (p. 205)	2	S	3	M. Geimer
2113809	Automotive Engineering I (p. 188)	4	W	6	F. Gauterin, M. Gießler
2114855	Automotive Engineering II (p. 189)	2	S	3	F. Gauterin, M. Gießler

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

Conditions
None.

Recommendations
Knowledge of the content of the courses *Engineering Mechanics I* [2161238] and *Engineering Mechanics II* [1262276] is helpful.

Qualification Goals
The student

- knows the most important components of a vehicle,
- knows and understands the functioning and the interaction of the individual components,
- knows the basics of dimensioning the components.

Content
See course descriptions.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Handling Characteristics of Motor Vehicles [WI4INGMB6]

Coordination: F. Gauterin
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2113806	Vehicle Comfort and Acoustics I (p. 274)	2	W	3	F. Gauterin
2114825	Vehicle Comfort and Acoustics II (p. 275)	2	S	3	F. Gauterin
2113807	Handling Characteristics of Motor Vehicles I (p. 272)	2	W	3	H. Unrau
2114838	Handling Characteristics of Motor Vehicles II (p. 273)	2	S	3	H. Unrau
2113816	Vehicle Mechatronics I (p. 276)	2	W	3	D. Ammon
2115817	Project Workshop: Automotive Engineering (p. 482)	3	W/S	4,5	F. Gauterin, M. Gießler, M. Frey
2114850	Global vehicle evaluation within virtual road test (p. 294)	2	S	3	B. Schick
2114856	Vehicle Ride Comfort & Acoustics I (p. 653)	2	S	3	F. Gauterin
2114857	Vehicle Ride Comfort & Acoustics II (p. 654)	2	S	3	F. Gauterin

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

Conditions
None.

Recommendations
Knowledge of the content of the courses *Engineering Mechanics I* [2161238], *Engineering Mechanics II* [2162276] and *Basics of Automotive Engineering I* [2113805], *Basics of Automotive Engineering II* [2114835] is helpful.

Qualification Goals
The student

- knows and understands the characteristics of vehicles, owing to the construction and design tokens,
- knows and understands especially the factors being relevant for comfort and acoustics
- is capable of fundamentally evaluating and rating handling characteristics.

Content
See courses.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Vehicle Development [WI4INGMB14]

Coordination: F. Gauterin
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2115817	Project Workshop: Automotive Engineering (p. 482)	3	W/S	4,5	F. Gauterin, M. Gießler, M. Frey
2113816	Vehicle Mechatronics I (p. 276)	2	W	3	D. Ammon
2113812	Fundamentals in the Development of Commercial Vehicles I (p. 320)	1	W	1,5	J. Zürn
2114844	Fundamentals in the Development of Commercial Vehicles II (p. 321)	1	S	1,5	J. Zürn
2113810	Fundamentals of Automobile Development I (p. 322)	1	W	1,5	R. Frech
2114842	Fundamentals of Automobile Development II (p. 323)	1	S	1,5	R. Frech
2114845	Tires and Wheel Development for Passenger Cars (p. 277)	2	S	3	G. Leister
2114095	Simulation of Coupled Systems (p. 576)	2	S	3	M. Geimer

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

Conditions
None.

Recommendations
Knowledge of the content of the courses *Engineering Mechanics I* [2161238], *Engineering Mechanics II* [2162276] and *Basics of Automotive Engineering I* [2113805], *Basics of Automotive Engineering II* [2114835] is helpful.

Qualification Goals
The student

- knows and understands the procedures in automobile development,
- knows and understands the technical specifications at the development procedures,
- is aware of notable boundaries like legislation.

Content
See courses.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Mobile Machines [WI4INGMB15]

Coordination: M. Geimer
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2114093	Fluid Technology (p. 286)	2	W	5	M. Geimer, M. Scherer
2114095	Simulation of Coupled Systems (p. 576)	2	S	3	M. Geimer
2114092	BUS-Controls (p. 205)	2	S	3	M. Geimer
2114073	Mobile Machines (p. 400)	4	S	6	M. Geimer
2113812	Fundamentals in the Development of Commercial Vehicles I (p. 320)	1	W	1,5	J. Zürn
2114844	Fundamentals in the Development of Commercial Vehicles II (p. 321)	1	S	1,5	J. Zürn

Learning Control / Examinations
The assessment is carried out as a general oral exam (according to Section 4(2), 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 examination is offered every semester. Re-examinations are offered at every ordinary examination date.
The overall grade of the module is the grade of the oral examination.
The assessment may be carried out as partial oral exams (according to Section 4(2), 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.In this case 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.
The assessment procedures are described for each course of the module seperately.

Conditions
None.

Recommendations
Knowledge of Fluid Power Systems are helpful, otherwise it is recommended to take the course *Fluid Power Systems* [2114093].

Qualification Goals
The student

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

Content
In the module of *Mobile Machines* [WI4INGMB15] the students will learn the structure of the machines and deepen the knowledge of the subject for developing the machines. After conclusion the module the student will know the latest developments in mobile machines and is able to evaluate the concepts and the trends of developments. The module is practically orientated and supported by industry partners.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Combustion Engines I [WI4INGMB34]

Coordination: H. Kubach
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2133113	Combustion Engines I (p. 656)	2/1	W	5	H. Kubach, T. Koch
2133121	Energy Conversion and Increased Efficiency in Internal Combustion Engines (p. 257)	2	W	4	T. Koch, H. Kubach

Learning Control / Examinations
The assessment consists of an oral exam (60 min) taking place in the recess period (according to §4 (2), 2 of the examination regulation). The exam takes place in every semester. Reexaminations are offered at every ordinary examination date.

Conditions
None.

Recommendations
None.

Qualification Goals
The student can name and explain the working princile of combustion engines. He is able to analyse and evaluate the combustion process. He is able to evaluate influences of gas exchange, mixture formation, fuels and exhaust gas aftertreatment on the combustion performance. He can solve basic research problems in the field of engine development.
The student can name all important influences on the combustion process. He can analyse and evaluate the engine process considering efficiency, emissions and potential.

Content
Introduction, History, Concepts
Working Principle and Termodynamics
Characteristic Parameters
Air Path
Fuel Path
Energy Conversion
Fuels
Emissions
Exhaust Gas Aftertreatment
Reaction kinetics
Gas exchange
Ignition
Flow field of gasoline engines
Working process
Pressure trace analysis
Thermodynamic analysis of the high pressure process
Exergy analysis and waste heat recuperation
Aspects of sustainability

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Combustion Engines II [WI4INGMB35]

Coordination: H. Kubach
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2134151	Combustion Engines II (p. 657)	2/1	S	5	H. Kubach, T. Koch
2133108	Fuels and Lubricants for Combustion Engines (p. 197)	2	W	4	B. Kehrwald
2134138	Fundamentals of catalytic exhaust gas aftertreatment (p. 310)	2	S	4	E. Lox
2134134	Analysis tools for combustion diagnostics (p. 394)	2	S	4	U. Wagner
2134137	Engine measurement techniques (p. 410)	2	S	4	S. Bernhardt
2134141	Gas Engines (p. 289)	2	S	4	R. Golloch
2134150	Analysis of Exhaust Gas und Lubricating Oil in Combustion Engines (p. 161)	2	S	4	M. Gohl
2134139	Model based Application Methods (p. 403)	2	S	4	F. Kirschbaum

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

Conditions
It is only possible to choose this module in combination with the module *Combustion Engines I.* The module is passed only after the final partial exam of *Combustion Engines I* is additionally passed.
The course *Combustion Engines II* [2134131] has to be attended.

Recommendations
Basic skills in thermodynamics are recommended.

Qualification Goals
See courses.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Introduction to Logistics [WI4INGMB20]

Coordination: K. Furmans
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2117051	Material flow in logistic systems (p. 389)	3/1	W	6	K. Furmans
2118183	IT-Fundamentals of Logistics (p. 357)	2	S	4	F. Thomas
2118097	Warehousing and distribution systems (p. 364)	2	S	4	M. Schwab, J. Weiblen
2117056	Airport logistics (p. 371)	2	W	4	A. Richter
2117061	Safety Engineering (p. 574)	2	W	4	H. Kany
2117064	Application of technical logistics in modern crane systems (p. 173)	2	W	4	M. Golder
2118089	Application of technical logistics in sorting- and distribution technology (p. 174)	2	S	4	J. Föller
2118085	Automotive Logistics (p. 370)	2	S	4	K. Furmans
2118094	Information Systems in Logistics and Supply Chain Management (p. 338)	2	S	4	C. Kilger
2117500	Energy efficient intralogistic systems (p. 253)	2	W	4	F. Schönung, M. Braun
2117095	Basics of Technical Logistics (p. 317)	3/1	W	6	M. Mittwollen, Madzharov
2117096	Elements of Technical Logistics (p. 244)	3	W	4	M. Mittwollen, Madzharov
2117097	Elements of Technical Logistics and Project (p. 245)	4	W	6	M. Mittwollen, Madzharov
2500005	Production and Logistics Controlling (p. 477)	2	W	3	H. Wlcek

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO) of the core course and further single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately. The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.
To improve the overall grade of the module up to one grading scale (0.3) there might be taken an optional term paper in the field of the IFL. The term paper may not be convalidated in the seminar module.

Conditions
It is obligatory to choose one of the following courses:

- *Material Flow in Logistic Systems*
- *Basics of technical logistics*
- *Elements and Systems of Technical Logistics*

Elements and systems of Technical Logistics is only allowed to be examined if *Basics of Technical Logistics* is passed successfully in this or an other module. For simultaneous attending of both courses, examination dates are sequenced accordingly.

Qualification Goals
The student

- acquires an overview of different logistic questions in practice,
- is able to model logistic systems with adequate accuracy by using simple models,
- is able to handle analytical methods for a performance evaluation of logistic systems,
- is able to identify cause and effects within logistic systems.

Content
The module *Introduction to Logistics* provides well-founded knowledge in main questions of logistics. In this module, focuses on the acquisition of theoretical basics linked with exemplary practice questions are laid. To gain a deeper understanding, the course is accompanied by exercises and further improved by case studies.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Specialization in Production Engineering [WI4INGMB22]

Coordination: V. Schulze
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2149667	Quality Management (p. 487)	2	W	4	G. Lanza
2149669	Materials and Processes for Body Lightweight Construction in the Automotive Industry (p. 390)	2	W	4	D. Steegmüller, S. Kienzle
2150681	Metal Forming (p. 642)	2	S	4	T. Herlan
2150683	Control Technology (p. 607)	2	S	4	C. Gönnheimer
2149655	Gear Cutting Technology (p. 673)	2	W	4	M. Klaiber
2149001	Production Technology and Management in Automotive (p. 479)	2	W	4	V. Stauch, S. Peters
2150601	Integrative Strategies in Production and Development of High Performance Cars (p. 350)	2	S	4	K. Schlichtenmayer

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO) 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. To improve the overall grade of the module up to one grading scale (0.3) there might be taken an optional term paper in the field of the wbk. The term paper may not be convalidated in the seminar module.

Conditions
None.

Qualification Goals
The students

- are able to apply the methods of production science to new problems.
- are able to analyze and evaluate the suitability of the methods, procedures and techniques for a specific problem.
- are able to use their knowledge target-oriented to achieve an efficient production technology.
- are able to analyze new situations and choose methods of production science target-oriented based on the analyses, as well as justifying their selection.
- are able to describe and compare complex production processes exemplarily.

Content
Within this module the students will get to know and learn about production science. Manifold lectures and excursions as part of several lectures provide specific insights into the field of production science.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Manufacturing Technology [WI4INGMB23]

Coordination: V. Schulze
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2149657	Manufacturing Technology (p. 281)	4/2	W	9	V. Schulze, F. Zanger

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1-3 SPO 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.
To improve the overall grade of the module up to one grading scale (0.3) there might be taken an optional term paper in the field of the wbk. The term paper may not be convalidated in the seminar module.

Conditions
None.

Qualification Goals
The students

- can name different manufacturing processes, can describe their specific characteristics and are capable to depict the general function of manufacturing processes and are able to assign manufacturing processes to the specific main groups.
- are enabled to identify correlations between different processes and to select a process depending on possible applications.
- are capable to describe the theoretical basics for the manufacturing processes they got to know within the scope of the course and are able to compare the processes.
- are able to correlate based on their knowledge in materials science the processing parameters with the resulting material properties by taking into account the microstructural effects.
- are qualified to evaluate different processes on a material scientific basis.

Content
Within this engineering sciences-oriented module the students will get to learn principle aspects of manufacturing technology. Further information can be found at the description of the lecture “Manufacturing Technology”.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Integrated Production Planning [WI4INGMB24]

Coordination: V. Schulze, Gisela Lanza
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2150660	Integrated production planning (p. 351)	4/2	S	9	G. Lanza

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1-3 SPO 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.
To improve the overall grade of the module up to one grading scale (0.3) there might be taken an optional term paper in the field of the wbk. The term paper may not be convalidated in the seminar module.

Conditions
None.

Qualification Goals
The students

- can discuss basic questions of production technology.
- are able to apply the methods of integrated production planning they have learned about to new problems.
- are able to analyze and evaluate the suitability of the methods, procedures and techniques they have learned about for a specific problem.
- can apply the learned methods of integrated production planning to new problems.
- can use their knowledge targeted for efficient production technology.

Content
Within this engineering sciences-oriented module the students will get to learn principle aspects of organization and planning of production systems. Further information can be found at the description of the lecture “Integrated Production Planning”.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Material Flow in Logistic Systems [WI4INGMB25]

Coordination: K. Furmans
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2117051	Material flow in logistic systems (p. 389)	3/1	W	6	K. Furmans
2118097	Warehousing and distribution systems (p. 364)	2	S	4	M. Schwab, J. Weiblen
2117056	Airport logistics (p. 371)	2	W	4	A. Richter
2118085	Automotive Logistics (p. 370)	2	S	4	K. Furmans
2500005	Production and Logistics Controlling (p. 477)	2	W	3	H. Wlcek

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 seperately. The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal. To improve the overall grade of the module up to one grading scale (0.3) there might be taken an optional term paper in the field of the IFL. The term paper may not be convalidated in the seminar module.

Conditions
The course Material *Flow in Logistic Systems* [2117051] is compulsory and must be examined.

Qualification Goals
The student

- acquires comprehensive and well-founded knowledge on the main topics of logistics, an overview of different logistic questions in practice and knows the functionality of material handling systems,
- is able to illustrate logistic systems with adequate accuracy by using simple models,
- is able to realize coherences within logistic systems,
- is able to evaluate logistic systems by using the learnt methods.

Content
The module *Material Flow in Logistic Systems* provides comprehensive and well-founded basics for the main topics of logistics. Within the lectures, the interaction between several components of logistic systems will be shown. The module focuses on technical characteristics of material handling systems as well as on methods for illustrating and evaluating logistics systems. To gain a deeper understanding, the course is accompanied by exercises and case studies.

Workload
Regular attendance: 270 hours (9 credits). Lectures with 120 hours 4 credits. Lectures with 180 hours 6 credits.

Remarks
If the course 2117051 „Materialfluss in Logistiksystemen“ had been taken already, one of the modules [WI4INGMB26], [WI4INGMB27] and [WI4INGMB28] can be chosen.

Module: Material Flow in Networked Logistic Systems [WI4INGMB26]

Coordination: K. Furmans
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2117059	Mathematical models and methods for Production Systems (p. 391)	3/1	W	6	K. Furmans, J. Stoll
2118097	Warehousing and distribution systems (p. 364)	2	S	4	M. Schwab, J. Weiblen
2117056	Airport logistics (p. 371)	2	W	4	A. Richter
2118085	Automotive Logistics (p. 370)	2	S	4	K. Furmans
2500005	Production and Logistics Controlling (p. 477)	2	W	3	H. Wlcek

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO) of the core course and further single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately. The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.
To improve the overall grade of the module up to one grading scale (0.3) there might be taken an optional term paper in the field of the IFL. The term paper may not be convalidated in the seminar module.

Conditions
The course *Analytical Models for Material Flow* [2117060] is compulsory and must be examined.

Qualification Goals
The student

- acquires in-depth knowledge on the main topics of logistics, gets an overview of different logistic questions in practice,
- is able to evaluate logistic systems by using the learnt methods,
- is able to analyze and explain the phenomena of industrial material and value streams.

Content
The module *Material Flow in networked Logistic Systems* provides in-depth basics for the main topics of logistics and industrial material and value streams. The obligatory lecture focuses on queuing methods to model production systems. To gain a deeper understanding, the course is accompanied by exercises.

Workload
Regular attendance: 270 hours (9 credits). Lectures with 180 hours attendance 6 credits. Lectures with 120 hours 4 credits.

Module: Technical Logistics [WI4INGMB27]

Coordination: K. Furmans
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every 2nd term, Winter Term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2117095	Basics of Technical Logistics (p. 317)	3/1	W	6	M. Mittwollen, Madzharov
2117096	Elements of Technical Logistics (p. 244)	3	W	4	M. Mittwollen, Madzharov
2117097	Elements of Technical Logistics and Project (p. 245)	4	W	6	M. Mittwollen, Madzharov
2118088	Selected Applications of Technical Logistics and Project (p. 184)	3/1	S	6	M. Mittwollen, Madzharov
2118087	Selected Applications of Technical Logistics (p. 183)	2/1	S	4	M. Mittwollen, Madzharov
2118183	IT-Fundamentals of Logistics (p. 357)	2	S	4	F. Thomas
2118097	Warehousing and distribution systems (p. 364)	2	S	4	M. Schwab, J. Weiblen
2117061	Safety Engineering (p. 574)	2	W	4	H. Kany
2117064	Application of technical logistics in modern crane systems (p. 173)	2	W	4	M. Golder
2118089	Application of technical logistics in sorting- and distribution technology (p. 174)	2	S	4	J. Föller
2117500	Energy efficient intralogistic systems (p. 253)	2	W	4	F. Schönung, M. Braun
2500005	Production and Logistics Controlling (p. 477)	2	W	3	H. Wlcek

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO) of the core course and further single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately. The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.
To improve the overall grade of the module up to one grading scale (0.3) there might be taken an optional term paper in the field of the IFL. The term paper may not be convalidated in the seminar module.

Conditions
The lecture *basics of technical logistics* has to be chosen. If the lecture *Basics of technical logistics* has been succesfully examinated in another module, the lecture *elements and systems of technical logistics* can be choosen instead. If both lectures are examinated successfully, one can chose selected applications of technical logistics or selected applications of technical logistics and project instead.

Qualification Goals
The student

- acquires well-founded knowledge on the main topics of technical logistics
- gets an overview of different applications of technical logistics in practice,
- acquires expertise and understanding about functionality of material handling systems.

Content
The module *Technical Logistics* provides in-depth basics on the main topics of technical logistics. The module focuses on technical characteristics of material handling technology. To gain a deeper understanding, the course is accompanied by exercises.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Logistics in Value Chain Networks [WI4INGMB28]

Coordination: K. Furmans
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2118078	Logistics - organisation, design and control of logistic systems (p. 369)	3/1	S	6	K. Furmans
2117062	Supply chain management (p. 621)	3/1	W	6	K. Alicke
2118097	Warehousing and distribution systems (p. 364)	2	S	4	M. Schwab, J. Weiblen
2117056	Airport logistics (p. 371)	2	W	4	A. Richter
2118085	Automotive Logistics (p. 370)	2	S	4	K. Furmans
2118094	Information Systems in Logistics and Supply Chain Management (p. 338)	2	S	4	C. Kilger
2500005	Production and Logistics Controlling (p. 477)	2	W	3	H. Wlcek

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO) of the core course and further single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately. The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.
To improve the overall grade of the module up to one grading scale (0.3) there might be taken an optional term paper in the field of the IFL. The term paper may not be convalidated in the seminar module.

Conditions
One of the lectures

- *Logistics – Organization, Design and Control of Logistic Systems* [2118078]
- *Supply Chain Management* [2117062]

is compulsory and must be examined. Also the course *Material flow in logistic systems* is mandatory. In case of combining this module with *Global Production and Logistics* [WI4INGMB31] the course *Material flow in logistic systems* is not compulsory.

Qualification Goals
The student

- is able to plan logistic systems and evaluate their performance,
- can use approaches of Supply Chain Management within the operational practice,
- identifies, analyses and evaluates risks within logistic systems.

Content
The module *Logistics in value chain networks* provides basics for the main topics of logistics. Within the lecture basic methods for planning and running logistic systems are introduced. Furthermore special issues like supply chain management and risks in logistic systems are focused. To gain a deeper understanding, the course is accompanied by exercises.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Virtual Engineering A [WI4INGMB29]

Coordination: J. Ovtcharova
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2121352	Virtual Engineering I (p. 674)	2/3	W	6	J. Ovtcharova
2122387	Computer Integrated Planning of New Products (p. 492)	2	S	4	R. Kläger
2123375	Virtual Reality Laboratory (p. 676)	3	W/S	4	J. Ovtcharova
2122376	PLM for product development in mechatronics (p. 449)	2/0	S	4	M. Eigner
2122014	Information Engineering (p. 337)	2	S	3	J. Ovtcharova, J. Ovtcharova
2121357	PLM-CAD Workshop (p. 450)	4	W/S	4	J. Ovtcharova

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

Conditions
The course *Virtual Engineering I* [2121352] is compulsory modules and must be examined.

Qualification Goals
The students should:

- have basic knowledge about the industrial application of Information Technology in product development,
- have understanding about current and future application of information systems in product development processes in the context of Product Lifecycle Management and Virtual Engineering,
- be able to operate current CAx- and PLM-systems in the product development process
- understands demands and relevance of interconnected IT-systems and respective methods for product development

Content
The Module Virtual Engineering A gives an overview about product development processes, beginning with requirement engineering, verification of manufacturing feasibility and virtual operation in the scope of Digital Factory. The guest-lectures contained in this module complete the content of the lecture with introducing current product development processes focusing.

Workload
Workload at 9 graduate credits / credit points: ca. 270 hours.

- regular attendance: 100 hours
- Preparation and reworking: 50 hours
- Exam and exam revision/preparation: 120 hours

Detailed apportionment results from credit points of the courses of the module

Module: Virtual Engineering B [WI4INGMB30]

Coordination: J. Ovtcharova
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2122378	Virtual Engineering II (p. 675)	2/1	S	4	J. Ovtcharova
2122387	Computer Integrated Planning of New Products (p. 492)	2	S	4	R. Kläger
2123375	Virtual Reality Laboratory (p. 676)	3	W/S	4	J. Ovtcharova
2123356	CATIA CAD training course (p. 213)	2	W/S	2	J. Ovtcharova
2123355	CAD-NX training course (p. 214)	2	W/S	2	J. Ovtcharova
2122376	PLM for product development in mechatronics (p. 449)	2/0	S	4	M. Eigner
2122014	Information Engineering (p. 337)	2	S	3	J. Ovtcharova, J. Ovtcharova
2121357	PLM-CAD Workshop (p. 450)	4	W/S	4	J. Ovtcharova

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

Conditions
The course *Virtual Engineering II* [2122378] is compulsory module and must be examined.

Recommendations
We recommend to attend/visit the courses *Engineering I* [2121352] before *Virtual Engineering II* [2122378]

Qualification Goals
The students should:

- have basic knowledge about industrial practice of Information Technology in the field of product development,
- have basic knowledge about innovative visualization techniques like Virtual Reality and feasible application of Virtual Mock-Ups (VMU) for validating product properties.
- Is able to estimate potentials and risks of current Virtual Reality Systems in product development.
- understands demands and relevance of interconnected IT-systems and respective methods for product development

Content
The module Virtual Engineering B communicates basics of Virtual Reality applications and their fields of application for validating product properties and for supporting product development processes.
Optional courses of this module complete the content with practical application of VR techniques in product development (Virtual Reality Exercise) and current product development processes.

Workload
Workload at 9 graduate credits / credit points: ca. 270 hours.

- regular attendance: 100 hours
- Preparation and reworking: 50 hours
- Exam and exam revision/preparation: 120 hours

Detailed apportionment results from credit points of the courses of the module

Module: Global Production and Logistics [WI4INGMB31]

Coordination: V. Schulze, G. Lanza
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2149610	Global Production and Logistics - Part 1: Global Production (p. 301)	2	W	4	G. Lanza
2149600	Global Production and Logistics - Part 2: Global Logistics (p. 302)	2	S	4	K. Furmans
2118085	Automotive Logistics (p. 370)	2	S	4	K. Furmans
2118094	Information Systems in Logistics and Supply Chain Management (p. 338)	2	S	4	C. Kilger
2149667	Quality Management (p. 487)	2	W	4	G. Lanza
2149001	Production Technology and Management in Automotive (p. 479)	2	W	4	V. Stauch, S. Peters
2150601	Integrative Strategies in Production and Development of High Performance Cars (p. 350)	2	S	4	K. Schlichtenmayer
2500005	Production and Logistics Controlling (p. 477)	2	W	3	H. Wlcek

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2) 1-3 SPO 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.
To improve the overall grade of the module up to one grading scale (0.3) there might be taken an optional term paper in the field of the IFL or the wbk. The term paper may not be convalidated in the seminar module.

Conditions
The lectures *Global Production and Logistics – part 1: Global Production* [2149610] and *part 2: Global Logistics [*2149600] are obligatory and must be examined.

Recommendations
The module should be combined with the module: *Logistic in Value Chain Networks* [WI4INGMB28] (in this case the course *Material flow in Logistic Systems* is not obligatory).

Qualification Goals
The students

- are able to analyze the main topics of global production and logistics.
- can explain the main topics about planning and operations of global supply chains and are able to use simple models for planning.
- are capable to name the main topics about planning of global production networks.

Content
The module Global Production and Logistics provides comprehensive and well-founded basics for the main topics of global production and logistics. The lectures aim to show opportunities and market conditions for global enterprises. Part 1 focuses on economic backgrounds, opportunities and risks of global production. Part 2 focuses on the structure of international logistics, their modeling, design and analysis. The threats in international logistics are discussed in case studies.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Machine Tools and Industrial Handling [WI4INGMB32]

Coordination: J. Fleischer
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2149902	Machine Tools and Industrial Handling (p. 683)	4/2	W	9	J. Fleischer

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1-3 SPO 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. To improve the overall grade of the module up to one grading scale (0.3) there might be taken an optional term paper in the field of the wbk. The term paper may not be convalidated in the seminar module.

Conditions
None.

Qualification Goals
The students

- are capable to explain the use and application of machine tools and handling devices as well as differentiate their characteristics and structure.
- are able to name and describe the essential components (frame, main spindles, feed axis, peripheral equipment, control) of machine tools.
- Are capable to distinguish and select and describe the essential components regarding structure, characteristics advantages and disadvantages.
- are enabled to dimension the main components of machine tools.
- are able to name and describe the control principles of machine tools.
- are capable to name examples of machine tools and industrial handling as well as to deduce compare the essential components. Additionally they can allocate manufacturing processes.
- are enabled to identify drawbacks as well as derive and asses measures for improvements.
- are qualified to apply methods for selection and evaluation of machine tools.
- are experienced to deduce the particular failure characteristics of a ball screw.

Content
The module overviews the assembly, dimensioning and application of machine tools and industrial handling. A consolidated and practice oriented knowledge is imparted about the choice, dimensioning and assessment of production machines. At first, the major components of machine tools are explained systematically. At this, the characteristics of dimensioning of machine tools are described in detail. Finally, the application of machine tools is demonstrated by means of example machines of the manufacturing processes turning, milling, grinding, massive forming, sheet metal forming and toothing.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Specific Topics in Materials Science [WI4INGMB33]

Coordination: M. Hoffmann
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2194643	Constitution and Properties of Wear resistant materials (p. 179)	2	S	4	S. Ulrich
2177601	Constitution and Properties of Protective Coatings (p. 180)	2	W	4	S. Ulrich
2125757	Introduction to Ceramics (p. 358)	3/1	W	6	M. Hoffmann
2173560	Welding Lab Course, in groupes (p. 271)	3	W	4	J. Hoffmeister
2174575	Foundry Technology (p. 298)	2	S	4	C. Wilhelm
2193010	Basic principles of powder metallurgical and ceramic processing (p. 308)	2	W	4	R. Oberacker
2182642	Laser in automotive engineering (p. 367)	2	S	4	J. Schneider
2183640	Laboratory “Laser Materials Processing” (p. 461)	3	W/S	4	J. Schneider, W. Pfleging
2181612	Physical basics of laser technology (p. 447)	2/1	W	5	J. Schneider
2173590	Polymer Engineering I (p. 451)	2	W	4	P. Elsner
2174596	Polymer Engineering II (p. 452)	2	S	4	P. Elsner
2125751	Practical Course Technical Ceramics (p. 462)	2	W	1	R. Oberacker
21565/21570	Welding Technology I/II (p. 509)	2	W/S	4	Spies
2177618	Superhard Thin Film Materials (p. 620)	2	W	4	S. Ulrich
2174576	Systematic Materials Selection (p. 625)	2/1	S	5	J. Hoffmeister
2181715	Failure of Structural Materials: Fatigue and Creep (p. 666)	2	W	4	O. Kraft, P. Gumbsch, P. Gruber
2181711	Failure of structural materials: deformation and fracture (p. 667)	2	W	4	P. Gumbsch, O. Kraft, D. Weygand
2126749	Advanced powder metals (p. 486)	2	S	4	R. Oberacker
2126775	Structural Ceramics (p. 619)	2	S	4	M. Hoffmann
2126730	Ceramics Processing (p. 359)	2	S	4	J. Binder
2125763	Structural and phase analysis (p. 618)	2	W	4	S. Wagner

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

Conditions
It is only possible to choose either the course *Physical Basics of Laser Technology* [21612] or the course *Laser Application in Automotive Engineering* [21642].

Recommendations
Knowledge, comparable to the content of the module *Emphasis Material Science* [WI3INGMB9], is highly recommended.
Natural science basic knowledge is assumed.

Qualification Goals
Students acquire special basic knowledge in selected areas of materials science and engineering and can apply them to

technical problems. Specific teaching objectives are agreed with the respective coordinator of the course.

Content
See courses.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Automated Manufacturing Systems [WI4INGMBWBK1]

Coordination: J. Fleischer
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2150904	Automated Manufacturing Systems (p. 186)	4/2	S	9	J. Fleischer

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1-3 SPO 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. To improve the overall grade of the module up to one grading scale (0.3) there might be taken an optional term paper in the field of the wbk. The term paper may not be convalidated in the seminar module.

Conditions
None.

Qualification Goals
The students

- are able to analyze implemented automated manufacturing systems and describe their components.
- are capable to assess the implemented examples of implemented automated manufacturing systems and apply them to new problems.
- are able to name automation tasks in manufacturing plants and name the components which are necessary for the implementation of each automation task.
- are capable with respect to a given task to plan the configuration of an automated manufacturing system and to determine the necessary components to its realization.
- are able to design and select components for a given use case of the categories: “Handling Technology”, “Industrial Robotics”, “Sensory” and “Controls”.
- are capable to compare different concepts for multi-machine systems and select a suitable concept for a given use case.

Content
Within this engineering sciences-oriented module the students will get to learn principle aspects of automated manufacturing systems. Further information can be found at the description of the lecture “Automated Manufacturing Systems”.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: BioMEMS [WI4INGMBIMT1]

Coordination: V. Saile
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2143875	Introduction to Microsystem Technology - Practical Course (p. 467)	2	W/S	3	A. Last
2143892	Selected Topics on Optics and Microoptics for Mechanical Engineers (p. 185)	2	W/S	3	T. Mappes
2141864	BioMEMS-Microsystems Technologies for Life-Sciences and Medicine I (p. 202)	2	W	3	A. Guber
2142883	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II (p. 200)	2	S	3	A. Guber
2142879	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III (p. 201)	2	S	3	A. Guber
2142881	Microactuators (p. 397)	2	S	3	M. Kohl
2143893	Replication processes in micro system technologies (p. 501)	2	W/S	3	M. Worgull
2142140	Bionics for Engineers and Natural Scientists (p. 203)	2	S	3	H. Hölscher
2143873	Actual topics of BioMEMS (p. 166)	2	W/S	3	A. Guber, Cattaneo, Giorgio

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

Conditions
The course BioMEMS I [2141864] is compulsory and must be examined.

Recommendations
See descriptions of individual lectures

Qualification Goals
The student

- has basic as well as extensive knowledge about different fields of applications of BioMEMS
- understands continuative aspects of the related subjects optics and microoptics, micro actuators, replications techniques and bionics

Content
Operations through small orifices, a pill which will take pictures on its way through your body or lab results right at the point of care - the need for easier and faster ways to help people is an important factor in research. The module BioMEMS (Bio(medical)-Micro-Electro-Mechanical-Systems) describes the application of microtechnology in the field of Life-Science, medical applications and Biotechnology and will teach you the necessary skills to understand and develop biological and medical devices.
The BioMEMS lectures will cover the fields of minimal invasive surgery, lab-on-chip systems, NOTES-Technology (Natural Orifice Transluminal Endoscopic Surgery), as well as endoscopic surgery and stent technology.

Additionally to the BioMEMS lectures you can specialize in various related fields like fabrication, actuation, optics and bionics. The course Replication processes will teach you some cost efficient and fast ways to produce parts for medical or biological devices. In the course Microactuation it is discussed how to receive movements in micrometer scale in a microsystem, this could be e.g. to drive micro pumps or micro valves. The necessary tools for optical measurement and methods of analysis to gain high resolution pictures are also part of this module. To deepen your knowledge and to get a hands-on experience this module contains a one week lab course. In the lecture bionics you can see how biological effects can be transferred into technical products.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
If you have any questions concerning the module, please contact Prof. Dr. Andreas E. Guber

Module: Microfabrication [WI4INGMBIMT2]

Coordination: V. Saile
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2143875	Introduction to Microsystem Technology - Practical Course (p. 467)	2	W/S	3	A. Last
2142890	Physics for Engineers (p. 446)	2/2	S	6	P. Gumbsch, A. Nesterov-Müller, D. Weygand, T. Förtsch
2143882	Fabrication Processes in Microsystem Technology (p. 280)	2	W/S	3	K. Bade
2143893	Replication processes in micro system technologies (p. 501)	2	W/S	3	M. Worgull
2143500	Chemical, physical and material science aspects of plastics in the micro technology (p. 218)	2	W/S	3	M. Worgull, D. Häringer
2141007	Fundamentals of X-ray Optics I (p. 315)	2	W	3	A. Last
2181712	Nanotribology and -Mechanics (p. 414)	2		3	M. Dienwiebel, H. Hölscher
2141853	Polymers in MEMS A: Chemistry, Synthesis and Applications (p. 453)	2	W	3	B. Rapp
2141854	Polymers in MEMS B: Physics, Microstructuring and Applications (p. 455)	2	W	3	M. Worgull
2142855	Polymers in MEMS C - Biopolymers and Bioplastics (p. 457)	2	S	3	M. Worgull, B. Rapp
2142856	(p. 460)	2	S	2	M. Worgull, B. Rapp

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

Conditions
The course Manufacturing Processes of Microsystem Technology [2143882] is compulsory and must be examined.

Recommendations
Knowledge of microsystem technology, mechanics, optics and physics is recommended.

Qualification Goals
The student

- gains advanced knowledge concerning fabrication techniques in micrometer scale
- aquires knowledge in up-to-date developing research
- can detect and use causal relation in microfabrication process chains.

Content
This engineering module allows the student to gain advanced knowledge in the area of microfabrication. Different manufacturing methods are described and analyzed in an advanced manner. Necessary interdisciplinary knowledge from physics, chemistry, materials science and also up-to-date developments (nano and x-ray optics) in micro fabrication is offered.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks

Starting summer term 2015, the course “Practical course Polymers in MEMS” [2142856] can be chosen in the module.
If you have any questions concerning the module, please contact Prof. Dr. Andreas E. Guber.

Module: Microoptics [WI4INGMBIMT3]

Coordination: V. Saile
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2143875	Introduction to Microsystem Technology - Practical Course (p. 467)	2	W/S	3	A. Last
2142884	Microoptics and Lithography (p. 396)	2	S	3	T. Mappes
2143892	Selected Topics on Optics and Microoptics for Mechanical Engineers (p. 185)	2	W/S	3	T. Mappes
2142881	Microactuators (p. 397)	2	S	3	M. Kohl
2141007	Fundamentals of X-ray Optics I (p. 315)	2	W	3	A. Last
23840	Laser Physics (p. 366)	2/1	W	4,5	M. Eichhorn
23462/23463	Optical Sources and Detectors (p. 430)	2/1	S	4,5	C. Koos
23464/23465	Optical Waveguides and Fibers (p. 431)	2/1	W	4,5	C. Koos
2142007	Fundamentals of X-ray optics II (p. 316)	2	S	3	A. Last

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

Conditions
The course Microoptics and Lithography [2142884] is compulsory and must be examined.

Recommendations
Basic knowlegde in electro dynamics is expected.
Attending Grundlagen der Mikrosystemtechnik I [2141861] and Grundlagen der Mikrosystemtechnik II [2142874] is recommended.

Qualification Goals

- basic knowlegde for the applications of microoptical systems
- understanding fabrication processes of microoptical elements & systems
- analyzing strengths and weaknesses of lithography processes
- knowledge on the basics of optical sources and detectors and their use in technical systems
- fundamental knowledge on different lasers and their design
- knowlegde on X-ray imaging methodes

Content
Optical imaging, measuring and sensor systems are a base for modern natural sciences. In particular life sciences and telecommunications have an intrinsic need for the application of optical technologies. Numerous fields of physics and engineering, e.g. astronomy and material sciences, require optical techniques. Micro optical systems are introduced in medical diagnostics and biological sensing as well as in products of the daily life.
In this module, an introduction to the basics of optics is provided; optical effects are presented with respect to their technical use.
Optical elements and instruments are presented. Fabrication processes of micro optical systems and elements, in particular lithography, are discussed.
In addition X-ray optics and X-ray imaging systems are presented as well as elements of optical telecommunication. A closer look on the physics behind lasers, being one of the most important technical light sources, is provided. As high end technology

and clean room equipment is present in all the lectures of this module, the students will have a hands-on training with several experiments in micro optics.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
If you have any questions concerning the module, please contact Prof. Dr. Andreas E. Guber.

Module: Microsystem Technology [WI4INGMBIMT4]

Coordination: V. Saile
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2141861	Introduction to Microsystem Technology I (p. 313)	2	W	3	A. Guber, Prof. J. Korvink
2142874	Introduction to Microsystem Technology II (p. 314)	2	S	3	A. Guber, Prof. Dr. J. Korvink
2143875	Introduction to Microsystem Technology - Practical Course (p. 467)	2	W/S	3	A. Last
2142890	Physics for Engineers (p. 446)	2/2	S	6	P. Gumbsch, A. Nesterov-Müller, D. Weygand, T. Förtsch
2143892	Selected Topics on Optics and Microoptics for Mechanical Engineers (p. 185)	2	W/S	3	T. Mappes
2142883	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II (p. 200)	2	S	3	A. Guber
2142879	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III (p. 201)	2	S	3	A. Guber
2142881	Microactuators (p. 397)	2	S	3	M. Kohl
2141865	Novel Actuators and Sensors (p. 418)	2	W	3	M. Kohl, M. Sommer
2143876	Nanotechnology with Clusterbeams (p. 412)	2	W	3	J. Gspann
2142140	Bionics for Engineers and Natural Scientists (p. 203)	2	S	3	H. Hölscher
23486 / 23487	Optoelectronic Components (p. 433)	2 / 1	S	4,5	W. Freude
2141853	Polymers in MEMS A: Chemistry, Synthesis and Applications (p. 453)	2	W	3	B. Rapp
2141854	Polymers in MEMS B: Physics, Microstructuring and Applications (p. 455)	2	W	3	M. Worgull
2142855	Polymers in MEMS C - Biopolymers and Bioplastics (p. 457)	2	S	3	M. Worgull, B. Rapp

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

Conditions
The course Basics of microsystem technology I [2141861] is compulsory and must be examined.

Qualification Goals

- construction and production of e. g. mechanical, optical, fluidic and sensory microsystems.

Content
The module offers courses in microsystem technology. Knowledge is imparted in various fields like basics in construction and production of e. g. mechanical, optical, fluidic and sensory microsystems.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
If you have any questions concerning the module, please contact Prof. Dr. Andreas E. Guber.

Module: Nanotechnology [WI4INGMBIMT5]

Coordination: V. Saile
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2143875	Introduction to Microsystem Technology - Practical Course (p. 467)	2	W/S	3	A. Last
2142860	Nanotechnologie using Scanning Probe Methods (p. 413)	2	S	3	H. Hölscher, M. Dienwiebel, S. Walheim
2141865	Novel Actuators and Sensors (p. 418)	2	W	3	M. Kohl, M. Sommer
2143876	Nanotechnology with Clusterbeams (p. 412)	2	W	3	J. Gspann
2181712	Nanotribology and -Mechanics (p. 414)	2		3	M. Dienwiebel, H. Hölscher
2142140	Bionics for Engineers and Natural Scientists (p. 203)	2	S	3	H. Hölscher
23476	Quantum Functional Devices and Semiconductor Technology (p. 326)	2	S	3	M. Walther

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

Conditions
The course Nanotechnology with Scanning Probe Methods [2142860] is compulsory and must be examined.

Recommendations
Knowledge in physics, mathematics, and chemistry is assumed.

Qualification Goals
The student

- has detailed knowledge in the field of nanotechnology
- is able to evaluate the specific characteristics of nanosystems.

Content
The module deals with the most important principles and fundamentals of modern nanotechnology. The compulsory module "Nanotechnology with scanning probe methods" introduces the basics of nanotechnology and nanoanalytics. The specific phenomena and properties found in nanoscale systems are the main topic of the module.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
If you have any questions concerning the module, please contact Prof. Dr. Andreas E. Guber.

Module: Optoelectronics and Optical Communication [WI4INGMBIMT6]

Coordination: V. Saile
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2143882	Fabrication Processes in Microsystem Technology (p. 280)	2	W/S	3	K. Bade
2141865	Novel Actuators and Sensors (p. 418)	2	W	3	M. Kohl, M. Sommer
23616 / 23618	Communication Systems and Protocols (p. 219)	2/1	S	4,5	J. Leuthold, J. Becker, M. Hübner
23840	Laser Physics (p. 366)	2/1	W	4,5	M. Eichhorn
23476	Quantum Functional Devices and Semiconductor Technology (p. 326)	2	S	3	M. Walther
23462/23463	Optical Sources and Detectors (p. 430)	2/1	S	4,5	C. Koos
23464/23465	Optical Waveguides and Fibers (p. 431)	2/1	W	4,5	C. Koos
23460 / 23461	Optical Communication Systems (p. 429)	2/1	W	4,5	J. Leuthold, W. Freude

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

Conditions
The course Optical Communication Systems [23460 / 23461] is compulsory and must be examined.
The course Manufacturing Processes of Microsystem Technology [2143882] can only be examined if the module Microfabrication is not chosen.

Recommendations
See descriptions of individual lectures.

Qualification Goals

- Student has basic knowledge of optical communication systems and related device and fabrication technologies.
- He/she can apply this knowledge to specific problems.

Content
This module covers practical and theoretical aspects in the areas of optical communications and optoelectronics. System aspects of communication networks are complemented by fundamental principles and device technologies of optoelectronics as well as and microsystem fabrication technologies.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
If you have any questions concerning the module, please contact Prof. Dr. Andreas E. Guber.

Module: Energy and Process Technology I [WI4INGMBITS1]

Coordination: H. Wirbser
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2157961	Energy and Process Technology I (p. 251)	4/2	W	9	H. Bauer, A. Velji, H. Wirbser, C. Höfler

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4 (2), 13 SPO) of the courses of this module, whose sum of credits must meet the 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.

Recommendations
Good skills in physics and chemistry and German.

Qualification Goals
In this modul students achieve a basic understanding of the technical properties of energy conversion processes and machines.

Content
Energy and Process Technology 1:
1. thermodynamic basics and cycle processes (ITT)
2. basics of piston engines (IFKM)
3. basics of turbomachines (FSM)
4. basics of thermal turbomachines (ITS)

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
All lectures and exams are hold in German only.

Module: Energy and Process Technology II [WI4INGMBITS2]

Coordination: H. Wirbser
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2170832	Energy and Process Technology II (p. 252)	4/2	S	9	C. Höfler, H. Wirbser

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4 (2), 13 SPO) of the courses of this module, whose sum of credits must meet the 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.

Recommendations
Good skills in German and knowledge of the content of the lecture „Energy and Process Technology I“.

Qualification Goals
In this modul students achieve the ability to evaluate solitary and interconnected energy systems with respect to societal and economical aspects

Content
Energy and Process Technology 2:
1. basics in combustion and pollutant formation (ITT)
2. technical realisation and application of piston engines (IFKM) fluid flow engines (FSM) and thermal turbomachines (ITS)
3. technical aspects of energy supply systems and networks (ITS)

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
All lectures and exams are hold in German only.

Module: Design, Construction, Operation and Maintenance of Highways [WI4INGBGU1]

Coordination: R. Roos
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
6200407	Design Basics in Highway Engineering (p. 193)	2/0	S	3	R. Roos
6233801	Design and Construction of Highways (p. 263)	2	S	3	R. Roos
6233802	Operation and Maintenance of Highways (p. 196)	2	S	3	R. Roos

Learning Control / Examinations
The assessment of the module consists of a written exam about the lecture *Design Basics in Highway Engineering* [19026] (according to §4(2), 1 of the examination regulation) and a conjoined oral exam “infrastructure management” about the lectures *Design and Construction Highways* [6233801] and *Operation and Maintenance Highways* [6233802] (according to §4(2), 2 of the examination regulation) (duration: 30 min.).
The exams are offered in each semester and may be resited to any ordinary ecxamination date.
The final mark for the module is the average of the marks for each course weighted by the credits and truncated after the first decimal.

Conditions
Writing a student research paper with the topics of the course *Design Basics in Highway Engineering* [19026] is obligatory.

Qualification Goals
See German version.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Highway Engineering [WI4INGBGU2]

Coordination: R. Roos
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
6233801	Design and Construction of Highways (p. 263)	2	S	3	R. Roos
6233802	Operation and Maintenance of Highways (p. 196)	2	S	3	R. Roos
6233804	Environmental Impact Assessment (p. 648)	1	S	1,5	R. Roos
6233807	Special Topics in Highway Engineering (p. 195)	1	S	1,5	R. Roos

Learning Control / Examinations
The assessment of the module consists of a conjoined oral exam about the lectures Special Topics in Highway Engineering [6233807] and *Environmental Impact Assessment* [6233804] (according to §4(2), 2 of the examination regulation) (duration: 15 min.) and a conjoined oral exam "infrastructure management" about the lectures *Design and Construction Highways* [6233801] and *Operation and Maintenance Highways* [6233802] (according to §4(2), 2 of the examination regulation) (duration: 30 min.).
The examination will take place on appointment. Resits are offered as needed.
The final mark for the module is the average of the marks for each course weighted by the credits and truncated after the first decimal.

Conditions
None.

Recommendations
The successful completion of the course *Design Basics in Highway Engineering* [19026] is assumed. This course may be attended in a previous study programme.

Qualification Goals
See German version.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
Writing a student research paper with the topics of the course *Design Basics in Highway Engineering* [19026] is obligatory.

Module: Safety, Computing and Law in Highway Engineering [WI4INGBGU9]

Coordination: R. Roos
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
6233901	IT-based Road Design (p. 236)	2	W	3	M. Zimmermann
6233906	Safety Management in Highway Engineering (p. 573)	2	W	3	M. Zimmermann
6233803	Laws concerning Traffic and Roads (p. 663)	2	S	3	D. Hönig

Learning Control / Examinations
See German version.

Conditions
The successful completion of the course *Design Basics in Highway Engineering* [6200407] is assumed. This course may be attended in the module *Design, Construction, Operation and Maintenance Highways* or be already completed in a previous study programme.

Qualification Goals
See German version.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Water Supply and Sanitation [WI4INGBGU13]

Coordination: E. Hoffmann
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
6223801	Process Technologies in Storm Water Treatment (p. 660)	2	S	3	S. Fuchs, E. Hoffmann
6223803	Process Technologies in Water Supply and Wastewater Disposal (p. 661)	2	S	3	E. Hoffmann
6220902	Urban Water Management (p. 650)	4	W	6	S. Fuchs, P. Klingel, U. Mohrlok
6200603	Water Supply and Sanitation (p. 575)	2/1	S	4,5	S. Fuchs

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO) of the chosen 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.

Recommendations
Basic knowledge of biology, physics and chemistry, taught at the upper secondary level, is helpful.

Qualification Goals
See German version.

Content

- Operation in the field of urban waste management
- Particular emphasis in regard to the Millenium Development

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Environmental Management [WI4INGBGU14]

Coordination: E. Hoffmann
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
6223701	Mass Fluxes (p. 611)	2	W	3	S. Fuchs
6223813	Seminar Water Quality (p. 527)	2	S	3	S. Fuchs, U. Mohrlok
6223814	Field Training Water Quality (p. 290)	2	S	3	S. Fuchs, U. Mohrlok

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO) of the choosen 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.

Recommendations
See German version.

Qualification Goals
The students develop system thinking and gain applicable knowledge and tools in regard to engineering methods.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Fundamentals of Transportation [WI4INGBGU15]

Coordination: P. Vortisch
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every 2nd term, Summer Term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
6232806	Characteristics of Transportation Systems (p. 241)	2	S	3	P. Vortisch
6232809	Freight Transport (p. 325)	1/1	S	3	B. Chlond
6232904	Long-distance and Air Traffic (p. 279)	2	W	3	B. Chlond, N.N., Wilko Manz
6232807	Tendering, Planning and Financing in Public Transport (p. 686)	2	S	3	W. Weißkopf
6232903	Seminar in Transportation (p. 549)	2	W/S	3	P. Vortisch, B. Chlond
2595475	Seminar Mobility Services (p. 538)	2	W	3	G. Satzger, C. Stryja
6200405	Transportation (p. 665)	2	S	3	P. Vortisch
6232811	Mobility Services and new Forms of Mobility (p. 401)	2	S	3	M. Kagerbauer
6232808	Strategic Transport Planning (p. 616)	2	S	3	V. Waßmuth

Learning Control / Examinations
The assessment is carried out as partial exams (according to § 4(2), 2-3 of the examination regulation) of the core course(s) and further single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module.
The overall grade of the module is the average of the grades for each course weighted by the credits.
The partial exams will take place jointly (if possible) at individually appointed dates.

Conditions
One course has to be chosen from the core courses. Core courses are: Fundamentals of Transportation Planning and Traffic Engineering [0170405] and Characteristics of Transportation Systems [6232806]. To achieve the required ECTS Credits, additional courses have to be chosen from the remaining courses.
From the courses Seminar in Transportation [6232903] and Seminar Mobility Services [2595475] only one course can be chosen.

Recommendations
Without any basic knowledge of transportation it is strongly recommended to choose both core courses, Fundamentals of Transportation Planning and Traffic Engineering [6200405] and Characteristics of Transportation Systems [6232806]. Otherwise only the core course Characteristics of Transportation Systems [6232806] should be chosen.

Qualification Goals
See German version.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Transportation Modelling and Traffic Management [WI4INGBGU16]

Coordination: P. Vortisch
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
6232701	Methods and Models in Transportation Planning (p. 194)	1/1	W	3	P. Vortisch, M. Kagerbauer
6232703	Traffic Engineering (p. 612)	1/1	W	3	P. Vortisch
6232802	Traffic Management and Transport Telematics (p. 664)	1/1	S	3	P. Vortisch
6232804	Traffic Flow Simulation (p. 579)	1/1	S	3	P. Vortisch
6232901	Transportation Data Analysis (p. 247)	2	W	3	M. Kagerbauer
6232809	Freight Transport (p. 325)	1/1	S	3	B. Chlond
6232904	Long-distance and Air Traffic (p. 279)	2	W	3	B. Chlond, N.N., Wilko Manz
6232807	Tendering, Planning and Financing in Public Transport (p. 686)	2	S	3	W. Weißkopf
6232903	Seminar in Transportation (p. 549)	2	W/S	3	P. Vortisch, B. Chlond
2595475	Seminar Mobility Services (p. 538)	2	W	3	G. Satzger, C. Stryja
6232811	Mobility Services and new Forms of Mobility (p. 401)	2	S	3	M. Kagerbauer
6232808	Strategic Transport Planning (p. 616)	2	S	3	V. Waßmuth

Learning Control / Examinations
The assessment is carried out as partial exams (according to § 4(2), 2-3 of the examination regulation) of the core courses and further single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The overall grade of the module is the average of the grades for each course weighted by the credits.
The partial exams will take place jointly (if possible) at individually appointed dates.

Conditions
Two courses have to be chosen from the core courses. Core courses are: *Methods and Models in Transportation Planning* [6232701], *Traffic Engineering* [6232703], *Traffic Management and Transport Telematics* [6232802] and *Traffic Flow Simulation* [6232804]. To achieve the requiered ECTS Credits, additional courses have to be chosen from the remaining courses. From the two possible seminars, only one can be chosen.

Recommendations
Basic knowledge of transportation is required.

Qualification Goals
See German version.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Process Engineering in Construction [WI4INGBGU22]

Coordination: S. Haghsheno
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
6241704	Process Engineering (p. 658)	2	W	3	H. Schneider, H. Schlick
6241703	Construction Equipment (p. 387)	2	W	3	S. Gentes
6241911	Operation Methods for Foundation and Marine Construction (p. 635)	1	W	1,5	H. Schneider
6241913	Operation Methods for Earthmoving (p. 264)	1	W	1,5	H. Schlick
6241910	Tunneling and Blasting (p. 640)	2	W	3	S. Haghsheno, L. Scheuble, U. Matz
6241826	Project Studies (p. 484)	1/1	S	3	S. Gentes
6241828	Disassembly Process Engineering (p. 659)	1/1	S	3	S. Gentes

Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO) of the core course and further single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.
The exam must be repeated at the latest 1 semester after the first try. The exam will be based on the content of the latest lecture.
Examination of courses Verfahrenstechnik [6241704] und Maschinentechnik [6241703] is carried out written. Combinations of courses Tiefbau [6241911], Erdbau [6241913], Tunnelbau und Sprengtechnik [6241910], Projektstudien [6241826] and Verfahrenstechniken der Demontage [6241828] are examined orally.

Conditions
The course Verfahrenstechnik [6241704] is compulsory and must be examined.

Recommendations
It is recommend to take the module Fundamentals of construction [WI3INGBGU3] from the Bachelor's degree program.

Qualification Goals
Students understand different processes and the related construction equipment, it's technology, capabilities and constraints. Students can define process solutions consisting of machinery and devices. They can evaluate existing processes through knowledge about process performance and operating conditions, and the can identify potential for improvement.

Content
Within the frame of this module, various construction und conditioning processes will be presented as well as performance calculations conducted. Students learn about the construction machinery and devices of these processes. Transmission, generation, conversion and controlling of power are explained with the help of various practical examples. Moreover, the module includes possibilities for an on-site familiarization.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Project in Public Transportation [WI4INGBGU25]

Coordination: Michael Weigel
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
6234810	Determination of Demand, Timetable Construction and Alignment (p. 192)	1/2	S	4,5	E. Hohnecker
6234904	Standard Valuation in Public Transport-Example (p. 598)	1	W	1,5	E. Hohnecker
6234901	Environmental Aspects of Guided Transport Systems (p. 644)	2	W	3	E. Hohnecker
6234902	Economic Efficiency of Guided Transport Systems (p. 687)	1	W	1,5	E. Hohnecker, staff
6234804	Operation Systems and Track Guided Infrastructure Capacity (p. 198)	2	S	3	E. Hohnecker, staff
6234805	Management in Public Transport (p. 376)	2	S	3	E. Hohnecker
6234903	Law Aspects of Guided Transport Systems (p. 493)	1	W	1,5	N. N.
n.n.	Homework "Project in Public Transportation" (p. 330)		W/S	3	E. Hohnecker, assistants

Learning Control / Examinations
See German version.

Conditions
See German version.

Recommendations
See German version.

Qualification Goals
See German version.

Content
See courses.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
Starting summer term 2015, this new module replaces the old module Project in Public Transportation [WW4INGBGU18]

Module: Public Transportation Operations [WI4INGBGU26]

Coordination: Michael Weigel
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
6234804	Operation Systems and Track Guided Infrastructure Capacity (p. 198)	2	S	3	E. Hohnecker, staff
6234805	Management in Public Transport (p. 376)	2	S	3	E. Hohnecker
6234901	Environmental Aspects of Guided Transport Systems (p. 644)	2	W	3	E. Hohnecker
6234902	Economic Efficiency of Guided Transport Systems (p. 687)	1	W	1,5	E. Hohnecker, staff
6234903	Law Aspects of Guided Transport Systems (p. 493)	1	W	1,5	N. N.
6232809	Freight Transport (p. 325)	1/1	S	3	B. Chlond
6234808	Infrastructure Equipment of Railway Tracks (p. 341)	1	S	1,5	E. Hohnecker, staff
6234809	Construction and Maintenance of Guided Track Infrastructure (p. 191)	1	S	1,5	E. Hohnecker, staff
n.n.	Homework “Public Transportation Operations” (p. 328)			3	E. Hohnecker, assistants

Learning Control / Examinations
The assessment mix of each course of this module is defined for each course separately. The final mark for the module is the average of the marks for each course weighted by the credits and truncated after the first decimal.
The exams are offered each semester. The re-examinations are offered upon prior agreement with the interested participants and not later than the next regular examination date.

Conditions
See German version.

Recommendations
See German version.

Qualification Goals
See German version.

Content
See courses.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
New module starting summer term 2015.

Module: Track Guided Transport Systems / Engineering [WI4INGBGU27]

Coordination: Michael Weigel
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
6234701	Track Guided Transport Systems - Technical Design and Components (p. 597)	3/1	W	6	E. Hohnecker
6234806	Infrastructure Dimensioning and Running Dynamics based Railway Alignment (p. 342)	1/1	S	3	E. Hohnecker, staff
6234808	Infrastructure Equipment of Railway Tracks (p. 341)	1	S	1,5	E. Hohnecker, staff
6234809	Construction and Maintenance of Guided Track Infrastructure (p. 191)	1	S	1,5	E. Hohnecker, staff
2114346	Electric Rail Vehicles (p. 243)	2	S	3	P. Gratzfeld
6234901	Environmental Aspects of Guided Transport Systems (p. 644)	2	W	3	E. Hohnecker
6234902	Economic Efficiency of Guided Transport Systems (p. 687)	1	W	1,5	E. Hohnecker, staff
6234903	Law Aspects of Guided Transport Systems (p. 493)	1	W	1,5	N. N.
n.n.	Homework “Track Guided Transport Systems / Engineering” (p. 329)			3	E. Hohnecker, assistants

Learning Control / Examinations
See German version.

Conditions
See German version.

Recommendations
See German version.

Qualification Goals
See German version.

Content
See courses.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
New module starting summer term 2015.

Module: Control Engineering II [WI4INGETIT2]

Coordination: M. Kluwe, S. Hohmann
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
23177	Control of Linear Multivariable Systems (p. 498)	3/1	W	6	M. Kluwe
23160	Automation of Discrete Event and Hybrid Systems (p. 187)	2/0	S	3	M. Kluwe

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.

Recommendations
For this module a basic knowledge in system theory and control engineering is assumed. These subjects can be found in the course *System Dynamics and Control Engineering* [23155] (within the Bachelor module *Control Engineering* [WW3INGETIT2]), which is recommended to have been attended beforehand.

Qualification Goals
The students

- have deeper knowledge in the field of control theory and system dynamics,
- are able to analyze multivariable systems in state space and frequency domain and are familiar with adequate methods for the control design,
- know the basics of modelling, simulation, analyses and control of discrete-event and hybrid systems.

Content
This module broadens the basic knowledge of system dynamics of the students to the multivariable case. Both I/O-models in frequency domain and mainly state space models are regarded, for which several methods for the analysis and the control design with different goals (decoupling, robustness) and constraints (disturbances, sensor failures) are presented. Above that, the basics of modelling, simulation, analysis and control of discrete-event and hybrid systems are discussed.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Sensor Technology I [WI4INGETIT3]

Coordination: W. Menesklou
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
23231	Sensors (p. 564)	2	W	3	W. Menesklou
23232	Experimental Laboratories in Sensors and Actuators (p. 463)	4	S	6	W. Menesklou
23240	Sensor Systems (Integrated Sensor Actuator Systems) (p. 565)	2	S	3	W. Wersing
23233	Seminar: Sensorik (p. 559)	2	W/S	3	W. Menesklou
21881	Microactuators (p. 398)	2	S	3	M. Kohl

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 course *Sensor Technology* [23231] is obligatory and has to be attended. The elected courses must not be credited in the module *Sensorik II* [WI4INGETIT5] or other modules.
Before *Experimental Laboratories in Sensors and Actuators* [23232] the course *Sensor Technology* [23231] has to be completed successfully.

Recommendations
Knowledge of electrical engineering is assumed. Therefore it is recommended to attend the courses *Electrical Engineering II* [23224] beforehand.

Qualification Goals
The student

- acquires fundamental principles in materials science and device technology of sensors.
- applies materials and sensors from the viewpoint of an application or development engineer.

Content
The operating principles of the most important sensors are taught. The student will learn to use the acquired knowledge for key issues relating to select and use sensors. Module *Sensor Technology I* gives an overview of the basic sensor principles. Module *Sensor Technology II* goes into specific topics of sensors and actuators further.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Sensor Technology II [WI4INGETIT5]

Coordination: W. Menesklou
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
23232	Experimental Laboratories in Sensors and Actuators (p. 463)	4	S	6	W. Menesklou
23240	Sensor Systems (Integrated Sensor Actuator Systems) (p. 565)	2	S	3	W. Wersing
23233	Seminar: Sensorik (p. 559)	2	W/S	3	W. Menesklou
21881	Microactuators (p. 398)	2	S	3	M. Kohl

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
It is only possible to choose this module in combination with the module *Sensor Technology I* [WI4INGETIT3]. The module is passed only after the final partial exam of *Sensor Technology I* is additionally passed.

Recommendations
Knowledge of electrical engineering is assumed. Therefore it is recommended to attend the courses *Electrical Engineering II* [23224] beforehand.

Qualification Goals
The student

- acquires fundamental principles in materials science and device technology of sensors.
- applies materials and sensors from the viewpoint of an application or development engineer.

Content
The operating principles of the most important sensors are taught. The student will learn to use the acquired knowledge for key issues relating to select and use sensors. Sensor module I gives an overview of the basic sensor principles. Sensor module II goes into specific topics of sensors and actuators further.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: High-Voltage Technology [WI4INGETIT6]

Coordination: T. Leibfried, B. Hoferer
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
23360/23362	High-Voltage Technology I (p. 332)	2/1	W	4,5	R. Badent
23361/23363	High-Voltage Technology II (p. 333)	2/1	S	4,5	R. Badent

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 examinations take place at the beginning of the recess period. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module seperately.
The overall grade of the module is the weighted average of the grades for each course and truncated after the first decimal.

Conditions
None.

Qualification Goals
The student

- has wide knowledge of electrical power engineering,
- is capable to analyse and develop electrical power engineering systems.

Content
The module deals with wide knowledge about the electrical power engineering. This ranges from the electric power equipment networks in terms of function, structure and interpretation on the calculation of electrical power networks to special areas such as the FACTS elements or power transformers.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Generation and transmission of renewable power [WI4INGETIT7]

Coordination: T. Leibfried, B. Hoferer
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
23372/23374	Power Transmission and Power Network Control (p. 256)	2/1	S	4,5	T. Leibfried
23371/23373	Power Network Analysis (p. 242)	2/2	W	6	T. Leibfried
23380	Photovoltaic Systems Technology (p. 445)	2/0	S	3	Schmidt
23392/23394	High-Voltage Test Technique (p. 331)	2/1	W	4,5	R. Badent

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 examinations take place at the beginning of the recess period. 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 weighted average of the grades for each course and truncated after the first decimal.

Conditions
It is only possible to choose this module in combination with the module *High-Voltage Technology* [WI4INGETIT6]. The module is passed only after the final partial exam of *High-Voltage Technology* is additionally passed.
The course Power Transmission and Power Network Control [23372/23374] or *Power Network Analysis [23371/23373]* is obligatory. *Power Network Analysis* can also be taken within the Bachelor's programme.

Qualification Goals
The student

- has wide knowledge of electrical power engineering,
- is capable to analyse and develop electrical power engineering systems.

Content
The module deals with wide knowledge about the electrical power engineering. This ranges from the electric power equipment networks in terms of function, structure and interpretation on the calculation of electrical power networks to special areas such as the FACTS elements or power transformers.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
The course 23381 Windpower will not be offered any more from winter term 2014/15 on. The examination will be offered latest until sommer term 2015 (repeaters only).

Module: Principles of Food Process Engineering [WI4INGCV3]

Coordination: V. Gaukel
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
22213	Principles of Food Process Engineering (p. 312)	2/0	W	4	V. Gaukel
22214	Specialization in Principles of Process Engineering referring to food (p. 669)	2/0	S	4	V. Gaukel
22205/6	Quality Management of Food Processing (p. 490)	1/1	S	3	Schuchmann
22207	Food Science and Functionality (p. 368)	2	W	4	Watzl

Learning Control / Examinations
The assessment is carried out by a general oral exam of the selected courses of this module, whose sum of credits must meet the minimum requirement of credits of this module (according to §4(2), 2 of the examination regulation).
The exam is offered upon agreement with the office of the section Food Process Engineering. Re-examination takes place at least 4 weeks after the last examination date.
The overal grade of the module is the gradeof the general oral exam.

Conditions
The courses *Principles of Process Engineering referring to Food I* [22213] and *Principles of Process Engineering referring to Food II* [22214] are obligatory and have to be attended.

Qualification Goals
See German version.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Specialization in Food Process Engineering [WI4INGCV4]

Coordination: V. Gaukel
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
22205/6	Quality Management of Food Processing (p. 490)	1/1	S	3	Schuchmann
22207	Food Science and Functionality (p. 368)	2	W	4	Watzl
6635	Microbiology of Food (p. 399)	2	W	4	Franz
22215	Product Design (p. 503)	2	S	4	Schuchmann
22218	Modern Measurement Techniques for Process Optimization (p. 408)	2	S	4	Regier
6602	Fundamentals of Food Chemistry (p. 311)	2	W/S	4	Loske
22229	Emulsifying and Dispersing (p. 248)	2	S	4	Köhler

Learning Control / Examinations
The assessment is carried out by a general oral exam of the selected courses of this module, whose sum of credits must meet the minimum requirement of credits of this module (according to §4(2), 2 of the examination regulation).
The exam is offered upon agreement with the office of the section Food Process Engineering. Re-examination takes place at least 4 weeks after the last examination date.
The overal grade of the module is the gradeof the general oral exam.

Conditions
It is only possible to choose this module in combination with the module *Principles of Food Process Engineering* [WI4INGCV3].
The module is passed only after the final partial exam of *Principles of Food Process Engineering* is additionally passed.
The course *Quality Management of Food Processing* [22205] is obligatory and has to attended. Has it already been attended in the Bachelor programme, an other course has to be chosen instead.

Qualification Goals
See German version.

Content
See courses.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
The course "Scale up in Biology and Engineering [22417]" will not be offered anymore.

Module: Water Chemistry and Water Technology I [WI4INGCV6]

Coordination: H. Horn
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

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

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
22601	Chemical Technology of Water (p. 217)	2/0	W	4	H. Horn
22602	Excercises in Chemical Technology of Water (p. 641)	1	W	2	H. Horn, Mitarbeiter
22664	Laboratory Work “Water” (p. 680)	2	W	4	H. Horn, G. Abbt-Braun

Learning Control / Examinations
The assessment is a general oral examination according to §4(2), 2 of the examination regulation about the chosen courses of this module, whose sum of credits must meet the minimum requirement of credits of this module.
The examination is offered on appointment, but at least 4 times per year in the first and last week of the summer and winter term.
The overall grade of the module is taken as the average from the individual grades of the oral examination and the grade of the excercises weighted by credit points.

Conditions
None.

Qualification Goals
The student

- has knowledge of types and sum of the water constituents and their interaction with each other and with the water molecules,
- knows and understands the basics of water chemistry and the most important methods for the treatment of different types of raw water.

Content
This module gives the basis to understand the most important methods of raw water treatment.
Therefore types and sum of water constituents and their interaction with each other and with water molecules are introduced. The effects of the different treatment and purification methods are shown

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Water Chemistry and Water Technology II [WI4INGCV7]

Coordination: H. Horn
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
22603	Scientific Bases for Examination and Assessement of Water Quality (p. 417)	2	W	4	G. Abbt-Braun
22618	Fundamentals of Waste Water Treatment (p. 304)	2/0	S	4	H. Horn
22612	Oxidation and Desinfection Processes (p. 439)	2/0	S	4	H. Horn
22605	Water Treatment with Membrane Technology (p. 181)	2	W	4	H. Horn, F. Saravia

Learning Control / Examinations

Conditions
It is only possible to choose this module in combination with the module *Water Chemistry I* [WI4INGCV6]. The module is passed only after the final partial exam of *Water Chemistry I* is additionally passed.

Qualification Goals
The student

- has knowledge of types and sum of the water constituents and their interaction with each other and with the water molecules,
- knows and understands the basics of water chemistry and the most important methods for the treatment of different types of raw water.
- knows about the different types of water treatment and water purification methods to convert, reduce or concentrate water constituents,

Content
The effects of the different treatment and purification methods are shown and it is explained how they can convert, reduce or concentrate water constituents.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Understanding and Prediction of Disasters 1 [WI4INGINTER7]

Coordination: M. Kunz
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
6222805	Morphodynamics (p. 409)	1/1	S	3	F. Nestmann
6224905	Environmental Communication (p. 645)	2/1	W	4	C. Kämpf
8048	River Engineering and Ecology I (p. 307)	2	W	3	E. Dister
8056	River Engineering and Ecology II (p. 287)	2	S	2	E. Dister
2600211/212	Geophysical Engineering (p. 343)	1/1	S	4	Wenzel, A. Barth
6200617	Water Resources Management and Engineering Hydrology (p. 681)	1/1	S	3	J. Ihringer
2501031	Advanced Measurement Methods (p. 288)	2	W	3,5	Kottmeier
9050	Basics in Hydrogeology (p. 309)	2/2	W	5	N. Goldscheider

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

Conditions
None.

Qualification Goals
See German version.

Content
See German version.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
Students, who successfully completed both modules “Understanding and Prediction of Disasters” I and II (alternatively: one of the modules in Bachelor and Master) can get a certificate of the module coordinator (CEDIM). This certificate lists the successful completed courses within the two modules.

Module: Understanding and Prediction of Disasters 2 [WI4INGINTER8]

Coordination: M. Kunz
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
6222805	Morphodynamics (p. 409)	1/1	S	3	F. Nestmann
6224905	Environmental Communication (p. 645)	2/1	W	4	C. Kämpf
8048	River Engineering and Ecology I (p. 307)	2	W	3	E. Dister
8056	River Engineering and Ecology II (p. 287)	2	S	2	E. Dister
2600211/212	Geophysical Engineering (p. 343)	1/1	S	4	Wenzel, A. Barth
6200617	Water Resources Management and Engineering Hydrology (p. 681)	1/1	S	3	J. Ihringer
2501031	Advanced Measurement Methods (p. 288)	2	W	3,5	Kottmeier
9050	Basics in Hydrogeology (p. 309)	2/2	W	5	N. Goldscheider

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

Conditions
None.

Qualification Goals
See German version.

Content
See German version.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
Students, who successfully completed both modules “Understanding and Prediction of Disasters” I and II (alternatively: one of the modules in Bachelor and Master) can get a certificate of the module coordinator (CEDIM). This certificate lists the successful completed courses within the two modules.

Module: Extracurricular Module in Engineering [WI4INGAPL]

Coordination: Prüfer einer Ingenieurwissenschaftlichen Fakultät
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Engineering Science

ECTS Credits	Cycle	Duration
9		

Learning Control / Examinations
The assessment of the module is determined by the respective module corrdinator. It can either be in the form of a general exam or partial exams, and must be contain at least 9 credit points and at least 6 hours per week. The examination may contain presentations, experiments, laboratories, term papers, etc. At least 50 percent of the module examination has to be in the form of a written or an oral examination (according to Section 4 (2), 1 or 2 of the examination regulation).

The formation of the overall grade of the module will be determined by the respective module coordinator.

Conditions
See German version.

Qualification Goals
See German version.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

5.7 Law

Module: Commercial Law [WI4JURA2]

Coordination: Z. (ZAR)
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Law

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
24504	Advanced Civil Law (p. 199)	2/0	S	3	T. Dreier
24011	Commercial and Corporate Law (p. 327)	2/0	W	3	Z. (ZAR), O. Knöfel
24506	Exercises in Civil Law (p. 474)	2/0	W/S	3	T. Dreier

Learning Control / Examinations

Conditions
None.

Qualification Goals
The student

- possesses in-depth knowledge of the general and specific law of obligations and of property law;
- is able to penetrate the interaction of the statutory provisions of the German Civil Code (different types of contracts and the respective rules on liability; performance; impairment of performance; the different ways by which property may be transferred and the *in rem* security rights) and of commercial and company law (especially in respect of the peculiarities of commercial transactions, commercial agency, the law of merchants as well as German law of business organizations);
- in the Private Law Exercises (”Privatrechtliche Übung”) gains the skill to solve legal problems using legal methods.

Content
The module is based on the module “Introduction in Civil Law”. The students get profound Knowledge in special contract types of the German Civil Law as well as in complex constructions in business law. In addition to that the module wants to impart the competence in solving legal problems with legal methods.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Intellectual Property Law [WI4JURA4]

Coordination: T. Dreier
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Law

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
24354	Internet Law (p. 356)	2/0	W	3	T. Dreier
24121	Copyright (p. 651)	2/0	W	3	T. Dreier
24656	Patent Law (p. 443)	2/0	S	3	P. Bittner
24136 / 24609	Trademark and Unfair Competition Law (p. 380)	2/0	W/S	3	Y. Matz
VGE	Computer Contract Law (p. 672)	2/0	W	3	M. Bartsch

Learning Control / Examinations
The assessment mix of each course of this module is defined for each course separately. The final mark for the module is the average of the marks for each course weighted by the credits and truncated after the first decimal.

Conditions
None.

Qualification Goals
See German version.

Content
See courses.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Private Business Law [WI4JURA5]

Coordination: Z. (ZAR)
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Law

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
24650	Civil Law for Advanced (p. 668)	2/0	S	3	Z. (ZAR)
24671	Law of Contracts (p. 671)	2/0	S	3	Z. (ZAR)
24167	Employment Law I (p. 175)	2	W	3	A. Hoff
24668	Employment Law II (p. 176)	2	S	3	A. Hoff
24168	Tax Law I (p. 605)	2/0	W	3	D. Dietrich
24646	Tax Law II (p. 606)	2/0	S	3	D. Dietrich

Learning Control / Examinations
The assessment mix of each course of this module is defined for each course separately. The final mark for the module is the average of the marks for each course weighted by the credits and truncated after the first decimal.

Conditions
None.

Recommendations
For the courses

- *Civil Law for Advanced* [24650]
- *Law of Contracts* [24671],

basic knowledge in civil law as taught in the courses *Civil Law for Beginners* [24012], *Advanced Civil Law* [24504], and *Commercial and Corporate Law* [24011] is required.

Qualification Goals
The student

- has gained in-depth knowledge of German company law, commercial law and civil law;
- is able to analyze, evaluate and solve complex legal and economic relations and problems;
- is well grounded in individual labour law, collective labour law and commercial constitutional law, evaluates and critically assesses clauses in labour contracts;
- recognizes the significance of the parties to collective labour agreements within the economic system and has differentiated knowledge of labour disputes law and the law governing the supply of temporary workers and of social law;
- possesses detailed knowledge of national earnings and corporate tax law and is able to deal with provisions of tax law in a scientific manner and assesses the effect of these provisions on corporate decision-making.

Content
The module provides the student with knowledge in special matters in business law, like employment law, tax law and business law, which are essential for managerial decisions.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Public Business Law [WI4JURA6]

Coordination: G. Sydow
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Law

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
24632	Telecommunications Law (p. 631)	2/0	S	3	G. Sydow
24082	Public Media Law (p. 423)	2	W	3	C. Kirchberg
24666	European and International Law (p. 269)	2/0	S	3	G. Sydow
24140	Environmental Law (p. 647)	2	W	3	G. Sydow
24018	Data Protection Law (p. 231)	2/0	W	3	G. Sydow

Learning Control / Examinations
The assessment mix of each course of this module is defined for each course separately. The final mark for the module is the average of the marks for each course weighted by the credits and truncated after the first decimal.

Conditions
None.

Qualification Goals
See German version.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Module: Governance, Risk & Compliance [WI4JURGRC]

Coordination: T. Dreier
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Law

ECTS Credits	Cycle	Duration
9	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
24121	Copyright (p. 651)	2/0	W	3	T. Dreier
24018	Data Protection Law (p. 231)	2/0	W	3	G. Sydow
24168	Tax Law I (p. 605)	2/0	W	3	D. Dietrich
24671	Law of Contracts (p. 671)	2/0	S	3	Z. (ZAR)
2400087	Corporate Compliance (p. 497)	2	W	3	T. Dreier, N.N.
2400041	Seminar: Governance, Risk & Compliance (p. 670)	2	S	3	T. Dreier, N.N.

Learning Control / Examinations

Conditions
None.

Qualification Goals
See German version.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

5.8 Sociology

Module: Sociology [WI4SOZ1]

Coordination: G. Nollmann
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject: Sociology

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
thSoz	Theoretical Sociology (p. 632)	2	W/S	2	G. Nollmann, Pfadenhauer, Haupt, Grenz, Eisewicht, Kunz, Albrecht, Enderle, Dukat
spezSoz	Special Sociology (p. 595)	2	W/S	4	G. Nollmann, Pfadenhauer, Haupt, Grenz, Eisewicht, Kunz, Dukat, Albrecht, Enderle
SozSem	Projectseminar (p. 483)	2	W/S	4	G. Nollmann, Kunz, Haupt, Grenz, Eisewicht, Enderle, Dukat, Albrecht

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

Conditions
Keine.

Recommendations
Knowledge of Statistics 1 and Statistics 2 is required.

Qualification Goals
The student

- Gains theoretical and methodical knowledge of social processes and structures.
- Is able to apply his/her gained knowledge practically.
- Is able to present his/her work results in a precise and clear way.

Content
The module sociology offers students the possibility to get to know problems touching social phenomens and to answer these theoretically as well as empirically. For example: Who does earn how much in his job and why? How do subcultures emerge? Why are boys' grades in school always worse than those of girls? Do divorces have negative influences on the development of children? How does mass consumption influence the individual? Is there a world society emerging?

In addition the module contains courses on sociological methods that are essential to answer the above questions scientifically.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

5.9 General Modules

Module: Seminar Module [WI4SEM]

Coordination: Studiendekan (Fak. f. Wirtschaftswissenschaften)
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject:

ECTS Credits	Cycle	Duration
9	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
SemAIFB1	Seminar in Enterprise Information Systems (p. 518)	2	W/S	3	R. Studer, A. Oberweis, T. Wolf, R. Kneuper
SemAIFB2	Seminar Efficient Algorithms (p. 521)	2	W/S	3	H. Schmeck
SemAIFB4	Seminar Knowledge Management (p. 550)	2	W	3	R. Studer
2530280	Seminar in Finance (p. 530)	2	W/S	3	M. Uhrig-Homburg, M. Ruckes
SemFBV1	Seminar Risk and Insurance Management (p. 544)	2	W/S	3	U. Werner
2530353	Seminar Financial Economics and Risk Management (p. 531)	2	W/S	3	M. Ulrich
2577915	Seminar: Management and Organization (p. 560)	2	W/S	3	H. Lindstädt
2579904	Seminar Management Accounting (p. 537)	2	W/S	3	M. Wouters
2579905	Special Topics in Management Accounting (p. 587)	2		3	M. Wouters, F. Stadtherr
SemIIP3	Seminar Business Ethics (p. 548)	2	W/S	3	A. Wollert
SemTuE1	Entrepreneurship Seminar (p. 525)			3	O. Terzidis
SemTuE2	Seminar Innovation management (p. 526)			3	M. Weissenberger-Eibl
2577919	„Good Governance“ at German Corporations (p. 690)	2	W/S	6	T. Reitmeyer
2572197	Seminar in strategic and behavioral marketing (p. 551)	2	W	3	B. Neibecker
SemETU2	Seminar in Marketing and Sales (Master) (p. 533)	2	W	3	M. Klarmann, S. Feurer
SemIIP2	Seminar in Industrial Production (p. 535)	2	W/S	3	F. Schultmann, M. Fröhling
2585420/2586420	Topics of Sustainable Management of Housing and Real Estate (p. 177)	2	W/S	3	T. Lützkendorf, D. Lorenz
SemEW	Seminar Energy Economics (p. 522)	2	W/S	3	W. Fichtner, P. Jochem, D. Keles, R. McKenna, V. Bertsch
2540510	Master Seminar in Information Engineering and Management (p. 388)	2	W	3	A. Geyer-Schulz
SemIW	Seminar Information Engineering and Management (p. 536)	2	W/S	3	C. Weinhardt
2595470	Seminar Service Science, Management & Engineering (p. 545)	2	W/S	3	C. Weinhardt, R. Studer, S. Nickel, H. Fromm, W. Fichtner, G. Satzger
2595477	Practical Seminar Service Innovation (p. 563)	3		4,5	G. Satzger
2595475	Seminar Mobility Services (p. 538)	2	W	3	G. Satzger, C. Stryja
SemWIOR2	Seminar Economic Theory (p. 688)	2	W/S	3	C. Puppe
SemWIOR3	Seminar in Experimental Economics (p. 553)	2	W/S	3	N. N.
n.n.	Seminar in Behavioral and Experimental Economics (p. 529)	2	W/S	3	P. Reiss

n.n.	Seminar on Topics in Experimental Economics (p. 540)	2	S	3	P. Reiss
SemPÖ1	Seminar on Morals and Social Behavior (p. 539)	2	W/S	3	N. Szech
SemPÖ2	Seminar on Topics in Political Economics (p. 541)	2	W/S	3	N. Szech
SemIWW2	Seminar in International Economy (p. 532)	2/0	W/S	3	J. Kowalski
SemIWW3	Seminar in Economic Policy (p. 534)	2	W/S	3	I. Ott
SemETS3	Seminar on Macroeconomic Theory (p. 555)	2		3	M. Hillebrand
2560130	Seminar Public Finance (p. 523)	2	W/S	3	B. Wigger, Assistenten
2560263	Seminar on Network Economics (p. 556)	2	W/S	3	K. Mitusch
2561209	Seminar Transport Economics (p. 557)	2	W/S	3	K. Mitusch, E. Szimba
2550491	Seminar in Discrete Optimization (p. 552)	2	W/S	3	S. Nickel
2550131	Seminar in Continous Optimization (p. 554)	2	W/S	3	O. Stein
SemWIOR1	Seminar Stochastic Models (p. 547)	2	W/S	3	K. Waldmann
SemSTAT	Seminar Statistics (p. 546)	2		3	N.N.
SemING	Seminar in Engineering Science (p. 344)	2	W/S	3	Fachvertreter ingenieurwissenschaftlicher Fakultäten
SemIFL	Seminar Conveying Technology and Logistics (p. 524)	2	W/S	3	K. Furmans
21690sem	Seminar paper "Production Engineering" (p. 561)	2	W/S	3	V. Schulze, G. Lanza, J. Fleischer
SemMath	Seminar in Mathematics (p. 393)	2	W/S	3	Fachvertreter der Fakultät für Mathematik
RECHT	Seminar: Legal Studies (p. 558)	2	W/S	3	Inst. ZAR
SQ HoC1	Academic learning (p. 511)	meist 2	W/S	2-3	HoC
SQ HoC2	Presentation and communication skills (p. 512)	meist 2	W/S	2-3	HoC
SQ HoC3	Working methodically (p. 513)	meist 2	W/S	2-3	HoC
SQ HoC4	Scientific writing (p. 514)	k.A.	W/S	2-3	HoC
SQ HoC5	Business in focus (p. 515)	k.A.	W/S	2-3	HoC
SQ PEW1	Elective „Educational development for student teachers" (p. 678)	k.A.	W/S	2 / 3	Personalentwicklung
SQ ZAK1	Key qualifications ZAK (p. 508)	k.A.	W/S	1-3	ZAK
2573011	Seminar Human Resource Management (p. 528)	2	W/S	3	P. Nieken
2573010	Seminar Human Resources and Organizations (p. 542)	2	W/S	3	P. Nieken
2540445	Seminar Pricing (p. 543)	2	S	3	J. Kim
semSTAT1	Applied Econometrics (p. 517)	2	W	3	M. Schienle
2520024	Topics in Econometrics (p. 636)	2	S	3	M. Schienle
2521388	Seminar Data Mining I (p. 519)	2	W	3	G. Nakhaeizadeh
2520375	Seminar Data Mining II (p. 520)	2	S	3	G. Nakhaeizadeh
2521391	(p. 600)	2	W	3	M. Höchstötter

Learning Control / Examinations
The modul examination consists of two seminars and of at least one key qualification (KQ) course (according to §4 (3), 3 of the examintaion regulation). A detailed description of every singled assessment is given in the specific course characerization.
The final mark for the module is the average of the marks for each of the two seminars weighted by the credits and truncated after the first decimal. Grades of the KQ courses are not included.

Conditions
The course specific preconditions must be observed.

- *Seminars*: Two seminars out of the course list, that have at least 3 CP each and are offered by a representative of the Department of Economics and Management or of the Center for applied legal studies (Department of Informatics), have to be chosen.
- Alternatively one of the two seminars can be absolved at a engineering department or at the Department of Mathematics. The seminar has to be offered by a representative of the respective department as well. The assessment has to meet the demands of the Department of Economics and Management (active participation, term paper with a workload of at least 80 h, presentation). This alternative seminar **requires an official approval** and can be applied at the examination office of the Department of Economics and Management. Seminars at the institutes wbk and IFL do not require these approval.
- *Key Qualification (KQ)-course(s)*: One or more courses with at least 3 CP in total of additional key qualifications have to be chosen among the courses [HoC, ZAK, Sprachenzentrum].

Qualification Goals

- The students are in a position to independently handle current, research-based tasks according to scientific criteria.
- They are able to research, analyze, abstract and critically review the information.
- They can draw own conclusions using their interdisciplinary knowledge from the less structured information and selectively develop current research results.
- They can logically and systematically present the obtained results both orally and in written form in accordance with scientific guidelines (structuring, technical terminology, referencing). They can argue and defend the results professionally in the discussion.

Content
Competences which are gained in the seminar module especially prepare the student for composing the final thesis. Within the term paper and the presentation the student exercises himself in scientific working techniques supported by the supervisor.
Beside advancing skills in techniques of scientific working there are gained integrative key qualifications as well. A detailled description o these qualifications is given in the section "Key Qualifications" of the module handbook.
Furthermore, the module also includes additional key qualifications provided by the KQ-courses.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Remarks
The listed seminar titles are placeholders. Currently offered seminars of each semester will be published on the websites of the institutes and in the course catalogue of the KIT. In general, the current seminar topics of each semester are already announced at the end of the previous semester. Furthermore for some seminars there is an application required.
The available places are listed on the internet: https://portal.wiwi.kit.edu.
The courses "Seminar Human Resource Management" [2573011] and "Seminar Human Resources and Organizations" [2573010] have both been added summer 2015.

Module: Master Thesis [WI4THESIS]

Coordination: Der Vorsitzende des Prüfungsausschusses
Degree programme: Wirtschaftsingenieurwesen (M.Sc.)
Subject:

ECTS Credits	Cycle	Duration
30		

Learning Control / Examinations
The Master Thesis is a written exam which shows that the student can autonomously investigate a scientific problem in Industrial Engineering and Management. The Master Thesis is described in detail in § 11 of the examination regulation.
The review is carried out by at least one examiner of the Department of Economics and Management, or, after approval by at least one examiner of another faculty. The examiner has to be involved in the degree programme. Involved in the degree programme are the persons that coordinate a module or a lecture of the degree programme.
The regular processing time takes six months. On a reasoned request of the student, the examination board can extend the processing time of a maximum of three month. If the Master Thesis is not completed in time, this exam is “failed”, unless the student is not being responsible (eg maternity leave).
With consent of the examinor the thesis can be written in English as well. Other languages require besides the consent of the examiner the approval of the examination board. The issue of the Master Thesis may only returned once and only within the first month of processing time. A new topic has to be released within four weeks.

The module grade is the grade for the Master Thesis.

Conditions
Prerequisite for admission to the Master thesis is that 50 percent of the credit points has to be completed.
A written confirmation of the examinor about supervising the Master Thesis is required.
Please pay regard to the institute specific rules for supervising a Master Thesis.

The Master Thesis has to contain the following declaration: “I hereby declare that I produced this thesis without external assistance, and that no other than the listed references have been used as sources of information. Passages taken literally or analogously from published or non published sources is marked as this.” If this declaration is not given, the Master Thesis will not be accepted.

Qualification Goals
The student can independently handle a complex and unfamiliar subject based on scientific criteria and on the current state of research.
He/she is in a position to critically analyze and structure the researched information as well as derive principles and regularities.
He/she knows how to apply the thereby achieved results to solve the task at hand. Taking into account this knowledge and his/her interdisciplinary knowledge, he/she can draw own conclusions, derive improvement potentials, propose and implement science-based decisions.
This is basically also done under consideration of social and/or ethical aspects.
He/she can interpret, evaluate and if required, graphically present the obtained results.
He/she is in a position to sensibly structure a research paper, document them and clearly communicate the results in scientific form.

Content
The Master Thesis is a major scientific work. The topic of the Master Thesis will be chosen by the student themselves and adjusted with the examinor. The topic has to be related to Industrial Engineering and Management and has to refer to subject-specific or interdisciplinary problems.

Workload
The total workload for this module is approximately 900 hours. For further information see German version.

6 Courses

6.1 All Courses

Course: Analysis of Exhaust Gas und Lubricating Oil in Combustion Engines [2134150]

Coordinators: M. Gohl
Part of the modules: Combustion Engines II (p. 98)[WI4INGMB35]

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

Learning Control / Examinations
Letter of attendance or oral exam (25 minutes, no auxillary means)

Conditions
none

Recommendations
Knowledge in the field of engine technology and measurement techniques is advantageous

Learning Outcomes
The Students can point out the challenges concerning the current emission standards in engine development. They can name and explain the basic principles of measurement techniques and methods to analyse exhaust gas components and components of engine oil. Hence, the students have the ability to choose the right methods for a given Problem and to interpret the results.

Content
The students get involved in the application of different measurement techniques in the field of exhaust gas and lubricating oil analysis. The functional principles of the systems as well as the application areas of the latter are discussed. In addition to a general overview of standard applications, current specific development and research activities are introduced.

Workload
regular attendance: 24 hrs
self study: 96 hrs

Media
Lecture with Powerpoint slides

Literature
The lecture documents are distributed during the courses.

Course: Advanced Econometrics of Financial Markets [2520381]

Coordinators: A. Nazemi
Part of the modules: Mathematical and Empirical Finance (p. 88)[WI4STAT1]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Summer term	en

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

Conditions
None.

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

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

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Media
transparencies, exercises.

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

Remarks
See German version.

Course: Advanced Game Theory [2521533]

Coordinators: P. Reiss, C. Puppe, K. Ehrhart
Part of the modules: Microeconomic Theory (p. 72)[WI4VWL15], Applied Strategic Decisions (p. 63)[WI4VWL2]

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

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

Conditions
None.

Recommendations
Basic knowledge of mathematics and statistics is assumed.

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

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Slides, problem sets.

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

Course: Advanced Management Accounting [2579907]

Coordinators: M. Wouters
Part of the modules: Cross-functional Management Accounting (p. 36)[WI4BWLIBU2]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	3	lecture + exercise	Winter term	en

Learning Control / Examinations
The assessment consists of an oral exam (20 min) taking place in the recess period (according to §4 (2), 2 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
The course is compulsory and must be examined.

Recommendations
The course requires significant prior knowledge of Management Accounting, similar to the content of the courses MA 1 and 2, although completion of these particular courses is not a formal requirement.

Learning Outcomes
Students will be able to identify and apply advanced management accounting methods to managerial decision-making problems in operations and innovation. They will also be able to identify relevant research results on such methods.

Content
The course addresses several topics where management accounting is strongly related to marketing, finance, or organization and strategy, such as customer value propositions, financial performance measures, managing new product development, and technology investment decisions.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Remarks
This course is held in English.

Course: Advanced Topics in Economic Theory [2520527]

Coordinators: M. Hillebrand, K. Mitusch
Part of the modules: Network Economics (p. 65)[WI4VWL4], Microeconomic Theory (p. 72)[WI4VWL15], Agglomeration and Innovation (p. 70)[WI4VWL13], Economic Theory and its Application in Finance (p. 71)[WI4VWL14]

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

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

Conditions
None.

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

Learning Outcomes
The students

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

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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

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

Course: Actual topics of BioMEMS [2143873]

Coordinators: A. Guber, Cattaneo, Giorgio
Part of the modules: BioMEMS (p. 116)[WI4INGMBIMT1]

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

Learning Control / Examinations
The assessment takes the form of a different type of control success (report and presentation) according to § 4 (2), 3 SPO.
The rating is 60% of the grade for the final paper to a special issue of BioMEMS and 40% of the grade for the seminar presentation held.

Conditions
None.

Recommendations
It is recommended to attend the courses BioMEMS I [2141864]], BioMEMS II [2142883] BioMEMS and III [2142879] beforehand.

Learning Outcomes
Knwolede in the actual activities in bio-medical and biological technologies under the view of micro technology. The student gets an overview on actual examples of new applications in BioMEMS.
After successfull participation of this seminar the student is able to prepare a new topic in BioMEMS and to present it to an audience.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Written preparations from the participants.

Course: Current issues in Innovation Management [2545018]

Coordinators: M. Weissenberger-Eibl
Part of the modules: Innovation Management (p. 58)[WI4BWLENT2]

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

Learning Control / Examinations
Die Erfolgskontrolle erfolgt in Form einer Erfolgskontrolle anderer Art (schriftliche Ausarbeitung) nach § 4(2), 3 SPO.
Die Note ist die Note der schriftlichen Ausarbeitung.

Conditions
None.

Recommendations
None.

Learning Outcomes
The aim of the course is the thoroughly examination of a current issues in Innovation Management.

Content
The aim of the course is the thoroughly examination of a current issues in Innovation Management.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Algorithms for Internet Applications [2511102]

Coordinators: H. Schmeck
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	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
- know new developments towards an Internet of Energy

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 new developments and challenges in the Internet of Energy.

Workload
The total workload for this course is approximately 150.0 hours. For further information see German version.

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.

Remarks
This course will not be offered after WS 2016/17

Course: Requirements Analysis and Requirements Management [2511218]

Coordinators: R. Kneuper
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Electives in Informatics (p. 82)[WI4INFO3], Informatics (p. 78)[WI4INFO1]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2/0	lecture	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

Workload
Workload: 120h overall,
Lecture 30h
Review and preparation of lectures 60h
Exam preparation 29h
Exam 1h

Literature
Literature will be given in the lecture.

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

Coordinators: J. Zöllner, N.N.
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Electives in Informatics (p. 82)[WI4INFO3], Informatics (p. 78)[WI4INFO1]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1/1	lecture + exercise + tutorial	Summer term	de

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

Conditions
None.

Recommendations
Knowledge of content of the module [WI1INFO].

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

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

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Media
Slides, internet resources.

Literature
Tba in the lecture.

Course: Applied Econometrics [2520020]

Coordinators: M. Schienle
Part of the modules: Mathematical and Empirical Finance (p. 88)[WI4STAT1], Econometrics and Statistics II (p. 92)[WI4STAT6], Econometrics and Statistics I (p. 91)[WI4STAT5], Statistical Methods in Risk Management (p. 89)[WI4STAT2]

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

Learning Control / Examinations
The assessment of this course is a written examination (90 min) according to §4(2), 1 of the examination regulation.

Conditions
None.

Learning Outcomes

Content

- asymptotics in the linear model, maximum likelihood estimation, IV
- theoretical and computer based exercises

Workload
The total workload for this course is approximately 135 hours.

Literature
Wooldridge, Greene

Remarks
The credits for the course have been changed from 5 to 4,5 from winter term 2015/2016 on.

Course: Planning and Management of Industrial Plants [2581952]

Coordinators: F. Schultmann
Part of the modules: Industrial Production II (p. 45)[WI4BWLIIP2]

ECTS Credits	Hours per week	Type	Term	Instruction language
5,5	2/2	lecture + exercise	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam (90 minutes) (following §4(2), 1 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Learning Outcomes

- Students shall be able to describe the tasks of plant management.
- Students shall be proficient in using selected methods of investment and cost estimates.
- Students shall be able to consider necessary processing and logistical requirements of designing industrial plants.
- Students shall be able to discuss interdependencies between capacity planning, process design and plant optimization.
- Students shall be proficient in discussing and applying selected methods of quality management, plant maintenance and plant dismantling.

Content
Industrial plant management incorporates a complex set of tasks along the entire life cycle of an industrial plant, starting with the initiation and erection up to operating and dismantling.
During this course students will get to know special characteristics of industrial plant management. Students will learn important methods to plan, realize and supervise the supply, start-up, maintenance, optimisation and shut-down of industrial plants. Alongside, students will have to handle the inherent question of choosing between technologies and evaluating each of them. This course pays special attention to the specific characteristics of plant engineering, commissioning and investment.

Workload
Total effort required will account for approximately 165h (5.5 credits).

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

Literature
will be announced in the course

Course: Application of technical logistics in modern crane systems [2117064]

Coordinators: M. Golder
Part of the modules: Technical Logistics (p. 106)[WI4INGMB27], Introduction to Logistics (p. 99)[WI4INGMB20]

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

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

Conditions
none

Recommendations
technical interest; Beneficial: Knowledge of the lecture 'Technical logistics I, basics'

Learning Outcomes
Students are capable to

- explain and apply relevant terms and their definitions like load, stress and strain
- name technical rules and standards applicable in crane design
- explain and discuss the importance of safety factors and dynamic factors
- name and describe the required verification measures in crane design
- describe the objective, approach and aspects when transferring the dynamic behavior of a crane into an elasto-kinetic model
- transfer the approach of dimensioning a bridge crane to any other material handling equipment

Content
Fundamentals of modern (bridge) crane design

- Content and application of relevant technical rules, standards and guidelines
- Terminology, definitions, dimensioning methods and verification measures in (bridge) crane design
- Concept of safety and dynamic factors
- Dimensioning of a bridge crane considering operating conditions, classification of different crane components as well as safety factors and dynamic factors
- Environmental factors on a crane system regarding strain, stability and fatigue strength
- Elasto-kinetic modelling of the dynamic behavior of a crane system and its quality

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
presentations, black board

Literature
None.

Remarks
none

Course: Application of technical logistics in sorting- and distribution technology [2118089]

Coordinators: J. Föller
Part of the modules: Technical Logistics (p. 106)[WI4INGMB27], Introduction to Logistics (p. 99)[WI4INGMB20]

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

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

Conditions
None.

Recommendations
None.

Learning Outcomes
Students are able to:

- Describe and classify basics and characteristics of application of sorting and distribution of goods,
- Solve drive and control tasks with appropriate concept selection,
- Design systems with appropriate calculation methods and evaluate them financially, and
- Judge about the confirmity of the system by using relevant standards and set of rules.

Content
Basics of goods sorting and distribution technology, employment characteristics, classification, interpretation, dimensioning, costs considerations. Relevant control, modern sets of rules and propulsion principles

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
presentations, black board

Literature
None.

Remarks
none

Course: Employment Law I [24167]

Coordinators: A. Hoff
Part of the modules: Private Business Law (p. 153)[WI4JURA5]

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

Learning Control / Examinations
The assessment consists of a written exam following §4, Abs. 2, 1 of the SPO.

Conditions
None.

Learning Outcomes
It is the aim of this lecture to provide a solid insight into individual-related labour law. The students will understand the importance of labour law as an integral part of social market economy. They will be able to review contractual provisions in employment contracts and to evaluate labour law conflicts.

Content
Students will be introduced to all labour law regulations concerning the beginning, enforcement and termination of an employment. The lecture provides an introduction into procedural matters. A labour court's trial will be attended.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
tba at the beginning of the course.

Course: Employment Law II [24668]

Coordinators: A. Hoff
Part of the modules: Private Business Law (p. 153)[WI4JURA5]

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

Learning Control / Examinations
The assessment consists of a written exam following §4, Abs. 2, 1 of the SPO.

Conditions
None.

Learning Outcomes
Based on the knowledge gained in the lecture on Labour Law I, the students are to gain a deeper insight into labour law.

Content
Students will gain insight into the statutory rights of employees and tariff law. They learn about the importance of employers associations and unions for the economy and gain adequate knowledge of laws concerning industrial action, supply of temporary workers and social security law.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Tba at the beginning of the course.

Course: Topics of Sustainable Management of Housing and Real Estate [2585420/2586420]

Coordinators: T. Lützkendorf, D. Lorenz
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar	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 and a presentation.

Conditions
None.

Learning Outcomes

- Students autonomously compile a paper treating of a marked-off subject within the area of real estate economics respectively sustainable construction, and present their results within the seminar.
- Therefore they master the principles of scientific writing, especially research, reasoning and citation, as well as handling information suspiciously.
- Through own and observed experiences they develop the ability to hold scientific presentations, including technical, formal, rethorical and didactical aspects.

Content
The seminar deals with changing up-to-date topics concerning Real Estate Economics or Sustainable Construction.
Current topics and schedules are announced at the beginning of term.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
A reader dealing with the basics of scientific writing is provided (in german language).

Course: Asset Pricing [2530555]

Coordinators: M. Uhrig-Homburg, M. Ruckes
Part of the modules: Finance 2 (p. 27)[WI4BWLFBV2], Finance 3 (p. 28)[WI4BWLFBV11], Finance 1 (p. 26)[WI4BWLFBV1], Economic Theory and its Application in Finance (p. 71)[WI4VWL14]

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

Learning Control / Examinations

Conditions
None.

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

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

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Basic literature

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

Elective literature

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

Course: Constitution and Properties of Wear resistant materials [2194643]

Coordinators: S. Ulrich
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

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

Learning Control / Examinations
The assessment consists of an oral exam (30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered upon agreement.

Conditions
The course *Material Science I* [21760] has to be completed beforehand.

Recommendations
Basic knowledge of natural science and knowledge of the content *Material Science II* [21782] is recommended.

Learning Outcomes
Basic understanding of constitution of wear-resistant materials, of the relations between constitution, properties and performance, of principles of increasing of hardness and toughness of materials as well as of the characteristics of the various groups of wear-resistant materials.

Content
introduction

materials and wear

unalloyed and alloyed tool steels

high speed steels

stellites and hard alloys

hard materials

hard metals

ceramic tool materials

superhard materials

new developments

Workload
regular attendance: 22 hours
self-study: 98 hours

Literature
Laska, R. Felsch, C.: Werkstoffkunde für Ingenieure, Vieweg Verlag, Braunschweig, 1981

Schedler, W.: Hartmetall für den Praktiker, VDI-Verlage, Düsseldorf, 1988

Schneider, J.: Schneidkeramik, Verlag moderne Industrie, Landsberg am Lech, 1995

Copies with figures and tables will be distributed

Course: Constitution and Properties of Protective Coatings [2177601]

Coordinators: S. Ulrich
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

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

Learning Control / Examinations
The assessment consists of an oral exam (30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered upon agreement.

Conditions
None

Recommendations
The module *Emphasis Material Science* [WI3INGMB9] should be completed successfully beforehand.
Basic knowledge of physics, chemistry and material science is assumed.

Learning Outcomes
Transfer of the basic knowledge of surface engineering, of the relations between constitution, properties and performance, of the manifold methods of modification, coating and characterization of surfaces.

Content
introduction and overview

concepts of surface modification

coating concepts

coating materials

methods of surface modification

coating methods

characterization methods

state of the art of industrial coating of tools and components

new developments of coating technology

Workload
regular attendance: 22 hours
self-study: 98 hours

Literature
Bach, F.-W.: Modern Surface Technology, Wiley-VCH, Weinheim, 2006

Copies with figures and tables will be distributed

Course: Water Treatment with Membrane Technology [22605]

Coordinators: H. Horn, F. Saravia
Part of the modules: Water Chemistry and Water Technology II (p. 147)[WI4INGCV7]

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

Learning Control / Examinations
See module description.

Conditions
None.

Learning Outcomes
The student

- has knowledge about the main processes in membrane filtration,
- knows about operation and function of membrane plants used in water treatment.

Content
1. Principles of membrane separation
2. Membrane manufacturing and membrane characteristics
3. Membrane configuration and membrane modules
4. Membrane plants in practice
5. Latest developments and trends

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Literature
Elective literature:

- Baker, R. W.: Membrane Technology and Applications. 2nd ed. Wiley & Sons, 2004.
- Crittenden, J. [Ed.]: Water Treatment. Principles and Design. 2nd ed. Wiley & Sons, 2005.
- Melin, T., Rautenbach, R.: Membranverfahren. Grundlagen der Modul- und Anlagenauslegung. 3., aktualis. u. erw. Aufl. Springer, 2007.
- Ohlrogge, K., Ebert, K. [Hrsg.]: Membranen. Grundlagen, Verfahren und industrielle Anwendungen. Wiley-VCH, 2006.

Course: Auction Theory [2520408]

Coordinators: K. Ehrhart
Part of the modules: Market Engineering (p. 41)[WI4BWLISM3], Microeconomic Theory (p. 72)[WI4VWL15], Applied Strategic Decisions (p. 63)[WI4VWL2]

ECTS Credits	Hours per week	Type	Term	Instruction language
4.5	2/1	lecture + exercise	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.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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: Selected Applications of Technical Logistics [2118087]

Coordinators: M. Mittwollen, Madzharov
Part of the modules: Technical Logistics (p. 106)[WI4INGMB27]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2/1	lecture + exercise	Summer term	de

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

Conditions
None.

Recommendations
As *selected applications of technical logistics* is based on the knowledge from *basics of technical logistics* and partly *elements and systems of technical logistics* it is strongly recommended to have heard at least *basics of technical logistics* in advance.

Learning Outcomes
Students are able to:

- Model the dynamic behaviour of material handling systems and based on this calculate the dynamical behaviour and
- Transfer this approach autonomous to further, different material handling installations and
- Discuss the knowledge with subject related persons.

Content
design and dimension of machines from intralogistics // static and dynamic behaviour // operation properties and specifics // visit of real intralogistic system
Inside practical lectures: sample applications and calculations in addition to the lectures

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Media
supplementary sheets,projector, blackboard

Literature
Recommendations during lessons

Remarks
-

Course: Selected Applications of Technical Logistics and Project [2118088]

Coordinators: M. Mittwollen, Madzharov
Part of the modules: Technical Logistics (p. 106)[WI4INGMB27]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	3/1		Summer term	de

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

Conditions
None.

Recommendations
As *selected applications of technical logistics* is based on the knowledge from *basics of technical logistics* and partly *elements and systems of technical logistics* it is strongly recommended to have heard at least *basics of technical logistics* in advance.

Learning Outcomes
Students are able to:

- Model the dynamic behaviour of material handling systems and based on this calculate the dynamical behaviour and
- Transfer this approach autonomous to further, different material handling installations,
- Discuss the knowledge with subject related persons and
- Judge about systems in place and justify it in front of subject related persons.

Content
design and dimension of machines from intralogistics // static and dynamic behaviour // operation properties and specifics // visit of real intralogistic system // self manufactured project report
Inside practical lectures: sample applications and calculations in addition to the lectures
Self manufacturing of a project report to recesses the topic.

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

Media
supplementary sheets,projector, blackboard

Literature
Recommendations during lessons

Course: Selected Topics on Optics and Microoptics for Mechanical Engineers [2143892]

Coordinators: T. Mappes
Part of the modules: Microoptics (p. 120)[WI4INGMBIMT3], Microsystem Technology (p. 122)[WI4INGMBIMT4], BioMEMS (p. 116)[WI4INGMBIMT1]

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

Learning Control / Examinations
The assessment will consist of a oral exam (20 min) (following §4 (2), 2 of the examination regulation.

Conditions
None.

Recommendations
None.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Automated Manufacturing Systems [2150904]

Coordinators: J. Fleischer
Part of the modules: Automated Manufacturing Systems (p. 115)[WI4INGMBWBK1]

ECTS Credits	Hours per week	Type	Term	Instruction language
9	4/2	lecture + exercise	Summer term	de

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

Conditions
None

Recommendations
None

Learning Outcomes
The students . . .

- are able to analyze implemented automated manufacturing systems and describe their components.
- are capable to assess the implemented examples of implemented automated manufacturing systems and apply them to new problems.
- are able to name automation tasks in manufacturing plants and name the components which are necessary for the implementation of each automation task.
- are capable with respect to a given task to plan the configuration of an automated manufacturing system and to determine the necessary components to its realization.
- are able to design and select components for a given use case of the categories: "Handling Technology", "Industrial Robotics", "Sensory" and "Controls".
- are capable to compare different concepts for multi-machine systems and select a suitable concept for a given use case.

Content
The lecture provides an overview of the structure and functioning of automated manufacturing systems. In the introduction chapter the basic elements for the realization of automated manufacturing systems are given. This includes:

- Drive and control technology
- Handling technology for handling work pieces and tools
- Industrial Robotics
- Quality assurance in automated manufacturing
- automatic machines, cells, centers and systems for manufacturing and assembly
- structures of multi-machine systems
- planning of automated manufacturing systems

In the second part of the lecture, the basics are illustrated using implemented manufacturing processes for the production of automotive components (chassis and drive technology).The analysis of automated manufacturing systems for manufacturing of defined components is also included.
In the field of vehicle power train both, the automated manufacturing process for the production of the conventional internal-combustion engine and the automated manufacturing process for the production of the prospective electric power train (electric motor and battery) are considered. In the field of car body, the focus is on the analysis of the process chain for the automated manufacturing of conventional sheet metal body parts, as well as for automated manufacturing of body components made out of fiber-reinforced plastics.
Within tutorials, the contents from the lecture are advanced and applied to specific problems and tasks.

Workload
regular attendance: 63 hours
self-study: 207 hours

Media
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).

Literature
Lecture Notes

Remarks
None

Course: Automation of Discrete Event and Hybrid Systems [23160]

Coordinators: M. Kluwe
Part of the modules: Control Engineering II (p. 139)[WI4INGETIT2]

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

Learning Control / Examinations
The assessment consists of an oral exam (20 min) according to §4(2), 2 of the examination regulation. The exam takes place at several dates in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Learning Outcomes
The students know some fundamental types and descriptions of discrete event models like automata or Petri nets and are able to use them systematically for the modeling of technical processes. Furthermore they are familiar with the analysis of the dynamic causal performance of a Petri net based on its reachability graph or its algebraic representation. Above that they are able to describe and analyze the dynamic temporal behaviour by means of the May-Plus-Algebra. The students know the hierarchy and the specifications of feedforward process control and have the knowledge to design especially interlocking control systems. Finally they have become acquainted with the basics of hybrid systems and means for their simulation, analysis and control.

Content
In the lecture the students get familiar with the basics of the modelling, simulation, analyses and control of discrete event and hybrid systems:

- *Introduction*
  system classification, definition, example: controlled charging process
- *Model classification and modeling formalisms*
  automata and formal languages, petri nets, net condition/event systems
- *Discrete process modeling*
  state-oriented modeling, resource-oriented modeling
- *Analysis of discrete event systems*
  characteristics of petri nets, analyzing petri nets, analyzing timed event graphs via Max-plus algebra
- *Specification and Design of discrete controllers*
  classification of control objectives and control, control specification, control design, implementation, control of a lifting table, control of a production line
- *Hybrid Systems*
  hybrid phenomena, simulation, analyzing and control of hybrid systems, example

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Supplemental sheets
Demonstration with Matlab/Simulink

Literature

- Cassandras, C. G., Lafortune, S.: Introduction to Discrete Event Systems, Springer, Netherlands, 2008

Elective literature:

- Abel, D.: Petri-Netze für Ingenieure, Springer Verlag Berlin, 1990

Course: Automotive Engineering I [2113809]

Coordinators: F. Gauterin, M. Gießler
Part of the modules: Automotive Engineering (p. 93)[WI4INGMB5]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	4	lecture	Winter term	en

Learning Control / Examinations
The assessment consists of a written exam (120 minutes) (following §4(2), 1 of the examination regulation).

Conditions
Can not be combined with lecture Grundlagen der Fahrzeugtechnik I.

Recommendations
None.

Learning Outcomes
The students know the movements and the forces at the vehicle and are familiar with active and passive security. They have proper knowledge about operation of engines and alternative drives, the necessary transmission between engine and drive wheels and the power distribution. They have an overview of the components necessary for the drive and have the basic knowledge, to analyze, to judge and to develop the complex system "vehicle".

Content
1. History and future of the automobile

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

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

4. Transmission: clutches (e.g. friction clutch, visco clutch), transmission (e.g. mechanical transmission, hydraulic fluid transmission)

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

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

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

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

Course: Automotive Engineering II [2114855]

Coordinators: F. Gauterin, M. Gießler
Part of the modules: Automotive Engineering (p. 93)[WI4INGMB5]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	en

Learning Control / Examinations
The assessment consists of a written exam (90 minutes) (following §4(2), 1 of the examination regulation).

Conditions
Can not be combined with lecture Grundlagen der Fahrzeugtechnik II .

Recommendations
None.

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

Content
1. Chassis: Wheel suspensions (rear axles, front axles, kinematics of axles), tyres, springs, damping devices
2. Steering elements: Steering elements of single vehicles and of trailers
3.Brakes: Disc brake, drum brake, retarder, comparison of the designs

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

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

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

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

Course: Basics of Liberalised Energy Markets [2581998]

Coordinators: W. Fichtner
Part of the modules: Energy Economics and Energy Markets (p. 49)[WI4BWLIIP4]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2/1	lecture + exercise	Winter term	en

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

Conditions
None.

Learning Outcomes
The student has detailed knowledge concerning the new challenges of liberalised energy markets. He has the ability to:

- Understand the new economic reality of liberalised energy markets
- Obtain a deeper understanding of the different submarkets of the power market
- Identify problems of the liberalised energy markets

Content
1. The European liberalisation process
1.1 The concept of a competitive market
1.2 The regulated market
1.3 Deregulation in Europe
2. Pricing and investments in a liberalised power market
2.1 Merit order
2.2 Prices and investments
2.3 Market flaws and market failure
2.4 Regulation in liberalised markets
2.5 Additional regulation mechanisms
3. The power market and the corresponding submarkets
3.1 List of submarkets
3.2 Types of submarkets
3.3 Market rules
4. Risk management
4.1 Uncertainties in a liberalised market
4.2 Investment decisions under uncertainty
4.3 Estimating future electricity prices
4.4 Portfolio management
5. Market power
5.1 Defining market power
5.2 Indicators of market power
5.3 Reducing market power
6. Market structures in the value chain of the power sector

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

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

Literature
Elective literature:
Power System Economics; Steven Stoft, IEEE Press/Wiley-Interscience Press, 0-471-15040-1

Remarks
The course “Basics of Liberalised Energy Markets” [2581998] will be reduced to 3 credits in winter term 2015/2016 and the tutorial [2581999] is no longer offered.

Course: Construction and Maintenance of Guided Track Infrastructure [6234809]

Coordinators: E. Hohnecker, staff
Part of the modules: Public Transportation Operations (p. 137)[WI4INGBGU26], Track Guided Transport Systems / Engineering (p. 138)[WI4INGBGU27]

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

Learning Control / Examinations
The assessment will consist of a oral exam (10 min) according to §4 (2), 1 of the examination regulation.
The exam is offered each semester. The re-examination is offered upon prior agreement with the interested participants and not later than the next regular examination date.

Conditions
See module description.

Learning Outcomes
See German version.

Content
methods of construction; strategies for maintenance; construction and operation

Workload
The total workload for this course is approximately 45.0 hours. For further information see German version.

Course: Determination of Demand, Timetable Construction and Alignment [6234810]

Coordinators: E. Hohnecker
Part of the modules: Project in Public Transportation (p. 136)[WI4INGBGU25]

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

Learning Control / Examinations
The assessment of the lectures *Determination of demand, Timetable construction and Alignment (supported by CAD)* [6234810; 6234811] consists of non exam assessments (an oral presentation and a written paper according §4(2), 3 of the examination regulation).
The mark consist of both parts of the assessment (50% of the mark of the presentation and 50% of the written paper).
The exam is offered each semester. The re-examination is offered upon prior agreement with the interested participants and not later than the next regular examination date.

Conditions
See module description.
The lecture is obligatory in the module *Project in Public Transportation*.

Recommendations
See module description.

Learning Outcomes
See German version.

Content
practise: urban traffic project: Planning and line-layouting

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Remarks
See German version.

Course: Design Basics in Highway Engineering [6200407]

Coordinators: R. Roos
Part of the modules: Design, Construction, Operation and Maintenance of Highways (p. 128)[WI4INGBGU1]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2/0	lecture + exercise	Summer term	de

Learning Control / Examinations
The assessment of the module is a written examination (40 minutes) according to Section 4(2), 1 of the examination regulation. The exam takes place every semester as well as the re-examination. In case of failing or to improve the examination grade an additional oral examination (according to Section 4(2), 2 of the examination regulation) is offered in the same examination periode.
The grade of the module corresponds to the grade of the written examination or the average of the marks for the written and the oral assessment.

Conditions
See corresponding module information.

Recommendations
Provision of first insights into methodologies and techniques in the fields of highway design and road construction.

Learning Outcomes
Provision of first insights into methodologies and techniques in the fields of highway design and road construction.

Content

- Highway design
- Road network layout
- Driving dynamics
- Fundamental principles of highway design in location, elevation and cross section
- Road construction
- Earthworks (requirements and test methods)
- Pavements (structure, construction methods and requirements)
- Pavement design according to the German guideline RStO

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Lecture notes are provided for download (infomation will be made available in the lecture).

Course: Methods and Models in Transportation Planning [6232701]

Coordinators: P. Vortisch, M. Kagerbauer
Part of the modules: Transportation Modelling and Traffic Management (p. 134)[WI4INGBGU16]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	1/1	lecture + exercise	Winter term	de

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

Conditions
See module description.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Special Topics in Highway Engineering [6233807]

Coordinators: R. Roos
Part of the modules: Highway Engineering (p. 129)[WI4INGBGU2]

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

Learning Control / Examinations
See module description.

Conditions
See corresponding module information.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 45.0 hours. For further information see German version.

Course: Operation and Maintenance of Highways [6233802]

Coordinators: R. Roos
Part of the modules: Design, Construction, Operation and Maintenance of Highways (p. 128)[WI4INGBGU1], Highway Engineering (p. 129)[WI4INGBGU2]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
See module description.

Conditions
See corresponding module information.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Fuels and Lubricants for Combustion Engines [2133108]

Coordinators: B. Kehrwald
Part of the modules: Combustion Engines II (p. 98)[WI4INGMB35]

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

Learning Control / Examinations
oral examination, Duration: ca. 25 min., no auxiliary means

Conditions
None.

Recommendations
None.

Learning Outcomes
The students can name and explain composition and meaning of fuels, lubricants and coolants as important components in the system of todays Otto and Diesel engines as well as definition and chemical composition of fuels and lubricants, the meanig of crude oil as basic primary product, production processes, major properties, standards and specifications, testing methods.
They can point out future worldwide trends in the field of conventional and alternative fuels regarding emission standards and energy conservation

Content
Introduction and basics

Fuels for Gasoline and Diesel engines

Hydrogen

Lubricants for Gasoline and Diesel engines

Coolants for combustion engines

Workload
regular attendance: 24 hours
self-study: 96 hours

Literature
Lecturer notes

Course: Operation Systems and Track Guided Infrastructure Capacity [6234804]

Coordinators: E. Hohnecker, staff
Part of the modules: Public Transportation Operations (p. 137)[WI4INGBGU26], Project in Public Transportation (p. 136)[WI4INGBGU25]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
The assessment will consist of a oral exam (20 min) according to §4 (2), 1 of the examination regulation.
The exam is offered each semester. The re-examination is offered upon prior agreement with the interested participants and not later than the next regular examination date.

Conditions
See module description.

Learning Outcomes
See German version.

Content
Special signalling equipments, automatic driving, safety case, capacity of railway equipments, dimensioning of marshaling yards, graph theory, Max-Plus Algebra

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Elective literature:
Fiedler: Grundlagen der Bahntechnik, Werner Verlag Düsseldorf
Pachl: Systemtechnik des Schienenverkehrs, Teubner-Verlag, Stuttgart

Remarks
See German version.

Course: Advanced Civil Law [24504]

Coordinators: T. Dreier
Part of the modules: Commercial Law (p. 151)[WI4JURA2]

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

Learning Control / Examinations
The assesment ist explained in the module description.

Conditions
The course *Civil law for beginners* [24012] is required.

Learning Outcomes
Following what the students have learned in the course *Civil law for beginners* about the basic notions of law and, in particular, the general part of the German Civil Code (Bürgerliches Gesetzbuch, BGB), in this course the students shall acquire knowledge of contract and of property law. They will learn about the statutory regulation of place, time and modalities of the performance of contractual duties, as well as the statutory rules governing defaults of performing contractual promises (impossibility of performance; non-performance; delayed performance, defective performance). In addition the students will be presented with the different types of contracts and with both liability for fault and strict liability. As far as property law is concerned, the students shall understand the different types of transfer of ownership and of securities the German Civil Code provides for.

Content
Following what the students have learned in the course Civil law for beginners about the basic notions of law and, in particular, the general part of the German Civil Code (Bürgerliches Gesetzbuch, BGB), in this course the students shall acquire knowledge of contract and of property law. On the one hand, this includes the statutory rules on place, time and modalities of performance, and the statutory rules governing defaults of performing contractual promises (impossibility of performance; non-performance; delayed performance, defective performance). On the other hand, the statutory types of contracts will be discussed (in particular, sale, lease, contract for work and contract for services, lending and borrowing) as well as new types of combined contracts (e.g., leasing, factoring, computer contracts). Moreover, legal liability will be discussed both with regard to liability for fault and with regard to strict liability. As regards property law, possession and ownership will be discussed as well as the different forms of transfer of ownership and the most important of the security rights.

Workload
The total workload for this course is approximately 90.0 hours. For further information see German version.

Media
Transparencies/Slides

Literature
Tba at the beginning of the course.
Elective literature:
tba at the beginning of the course

Course: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II [2142883]

Coordinators: A. Guber
Part of the modules: Microsystem Technology (p. 122)[WI4INGMBIMT4], BioMEMS (p. 116)[WI4INGMBIMT1]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
The assessment will consist of a oral exam (30 min) (following §4 (2), 2 of the examination regulation).

Conditions
None.

Recommendations
It is recommended to attend course BioMEMS I [2141864] beforehand.

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

Content
Examples of use in Life-Sciences and biomedicine: Microfluidic Systems:
LabCD, Protein Cristallisation
Microarrys
Tissue Engineering
Cell Chip Systems
Drug Delivery Systems
Micro reaction technology
Microfluidic Cells for FTIR-Spectroscopy
Microsystem Technology for Anesthesia, Intensive Care and Infusion
Analysis Systems of Person´s Breath
Neurobionics and Neuroprosthesis
Nano Surgery

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Lecture script

Literature
Menz, W., Mohr, J., O. Paul: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 2005

Buess, G.: Operationslehre in der endoskopischen Chirurgie, Band I und II;
Springer-Verlag, 1994
M. Madou
Fundamentals of Microfabrication

Course: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III [2142879]

Coordinators: A. Guber
Part of the modules: Microsystem Technology (p. 122)[WI4INGMBIMT4], BioMEMS (p. 116)[WI4INGMBIMT1]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
The assessment will consist of a oral exam (30 min) (following §4 (2), 2 of the examination regulation).

Conditions
None.

Recommendations
It is recommended to attend course BioMEMS I [2141864] beforehand.

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

Content
Examples of use in minimally invasive therapy
Minimally invasive surgery (MIS)
Endoscopic neurosurgery
Interventional cardiology
NOTES
OP-robots and Endosystems
License of Medical Products and Quality Management

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Lecture script

Literature
Menz, W., Mohr, J., O. Paul: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 2005
Buess, G.: Operationslehre in der endoskopischen Chirurgie, Band I und II;
Springer-Verlag, 1994
M. Madou
Fundamentals of Microfabrication

Course: BioMEMS-Microsystems Technologies for Life-Sciences and Medicine I [2141864]

Coordinators: A. Guber
Part of the modules: BioMEMS (p. 116)[WI4INGMBIMT1]

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

Learning Control / Examinations
The assessment will consist of a oral exam (30 min) (following §4 (2), 2 of the examination regulation.

Conditions
The course is compulsory in the module BioMEMS and must be examined.

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

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

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Lecture script

Literature
Menz, W., Mohr, J., O. Paul: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 2005
M. Madou
Fundamentals of Microfabrication
Taylor & Francis Ltd.; Auflage: 3. Auflage. 2011

Course: Bionics for Engineers and Natural Scientists [2142140]

Coordinators: H. Hölscher
Part of the modules: Nanotechnology (p. 124)[WI4INGMBIMT5], Microsystem Technology (p. 122)[WI4INGMBIMT4], BioMEMS (p. 116)[WI4INGMBIMT1]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
The successfull attandence of the lecture is controlled by a 30 minutes written examination, and a subsequent oral examination (20 min). Passing the written exam is mandantory for the participation of the oral examination. The grade result is the result of the oral exam.

Conditions
None.

Recommendations
Basic knowledge in physics and chemistry

Learning Outcomes
The students should be able analyze, judge, plan and develop biomimetic strategies and products.

Content
Bionics focuses on the design of technical products following the example of nature. For this purpose we have to learn from nature and to understand its basic design rules. Therefore, the lecture focuses on the analysis of the fascinating effects used by many plants and animals. Possible implementations into technical products are discussed in the end.

Workload
lectures 30 h
self study 30 h
preparation for examination 30 h

Media
Slides of the lectures

Literature
Werner Nachtigall: Bionik – Grundlagen und Beispiele für Ingenieure und Naturwissenschaftler. Springer-Verlag Berlin (2002), 2. Aufl.

Course: Exchanges [2530296]

Coordinators: J. Franke
Part of the modules: Finance 3 (p. 28)[WI4BWLFBV11], Finance 2 (p. 27)[WI4BWLFBV2]

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

Learning Control / Examinations

Conditions
None.

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

Content

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

Workload
The total workload for this course is approximately 45.0 hours. For further information see German version.

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

Course: BUS-Controls [2114092]

Coordinators: M. Geimer
Part of the modules: Automotive Engineering (p. 93)[WI4INGMB5], Mobile Machines (p. 96)[WI4INGMB15]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
Assessment for the module *Mobile Machines*: See module description.
Assessment for the module *Automotive Engineering*: The assessment consists of an oral exam (20 min) taking place in 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
Basic knowledge of electrical engineering is recommended. Programming skills are also helpful.

Learning Outcomes
The students will get an overview of the theoretic and practical functioning of different bus systems.

After the practical oriented lessons the students will be able to visualize the communication structure of different applications, design basic systems and evaluate the complexity of programming of the complete system.

Content

- Knowledge of the basics of data communication in networks
- Overview of the operating mode of current field buses
- Explicit observation of the operating mode and application areas of CAN buses
- Practical programming of an example application (hardware is provided)

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Elective literature:

- Etschberger, K.: Controller Area Network, Grundlagen, Protokolle, Bausteine, Anwendungen; München, Wien: Carl Hanser Verlag, 2002.
- Engels, H.: CAN-Bus - CAN-Bus-Technik einfach, anschaulich und praxisnah dargestellt; Poing: Franzis Verlag, 2002.

Remarks
The course will be replenished by interesting lectures of professionals.

Course: Business Activity Management [2511506]

Coordinators: C. Janiesch
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Summer 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
The course might be combined with the lecture “Service Oriented Computing 1”.

Learning Outcomes
Students will acquire a deep and systematic understanding of how process data can be accessed and KPI can be measures in service-oriented and event-driven processes in order to allow for decision making in real-time. Equipped with practical and research-based knowledge, they will be enabled to engineer business activity management applications with state-of-art technologies and gain a broad understanding of methods and best practices for their own work.

Content
The lecture “Business Activity Management” covers technical and organizational aspects with respect to the development and use of modern real-time monitoring and management systems for business process management and service-oriented computing. It introduces background, trends, and technologies and of BPM, Business Intelligence, Complex Event Processing and their combination towards buisness activity management.

The topics of the lecture include e.g.:

- Business Intelligence
- Process Modeling
- Business Rules
- Complex Event Processing
- Event-driven Architectures
- Event-driven Business Process Management
- Software for BPM, BI, and CEP
- BPM in the Cloud

Workload
see German version.

Media
Slides in PDF-format will be provided via the course webpages.

Literature
Compulsory literature will be announced in the course.

Remarks
The course will not be offered any more from winter term 2014/15 on. The examination will be offered latest until winter term 2015/16 (repeaters only).

Course: Business and IT Service Management [2595484]

Coordinators: G. Satzger
Part of the modules: Service Management (p. 43)[WI4BWLISM6]

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

Learning Control / Examinations
The assessment of this course is a written examination (60 min.) (following §4(2), 1 SPO) and by submitting written papers as part of the exercise (following §4(2), 3 SPO).

Conditions
None.

Learning Outcomes
Students understand the importance of “servitization” for organizations, the challenges for the management of service-oriented enterprises and the interdependence of business and IT services.
Students learn standard concepts and methods of service-oriented management and are able to apply them in practical case studies.
Student get familiar with current research and tools and are able to critically evaluate them.
Students practice to communicate in English and to work on solutions in teams.

Content
The rapid development of information and communication technology transforms many enterprises towards service-oriented structures: with new digital services, new business models and process structures within larger service networks. Thus, strategic and operative management of service-oriented enterprises increasingly gains importance. In this course, we want to systematically acquire relevant know-how and apply this to real word examples. Particular focus will be on the interdependence of business, IT and legal aspects.
The course will be taught in English. It should provide ample opportunity for active participation of students. The course will integrate presentations of experts from business practice as well as a comprehensive case study (”en bloc” for 1 day) in which students will actively work on the strategic service-oriented shift of an enterprise.

Workload
The total workload for this course is approximately 135 hours. For further information see German version.

Media
Presentation (pdf)

Literature
Fitzsimmons J./Fitzsimmons, M., Service Management, Operations, Strategy and Information Technology, 6. ed., 2007
Maister, David H., Managing The Professional Service Firm, 1997
Teboul, J. , Service is Front Stage: Positioning services for value advantage, 2006
Grönroos, Service Management and Marketing, 2007

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

Course: Business Dynamics [2540531]

Coordinators: A. Geyer-Schulz, P. Glenn
Part of the modules: Advanced CRM (p. 37)[WI4BWLISM1], Electronic Markets (p. 39)[WI4BWLISM2]

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

Learning Control / Examinations
Assessment consists of a written exam of 1 hour length following §4 (2), 1 of the examination regulation and by submitting written papers as part of the exercise following §4 (2), 3 of the examination regulation.
The course is considered successfully taken, if at least 50 out of 100 points are acquired in the written exam. In this case, all additional points (up to 10) from excersise work will be added. The grades of this lecture are assigned following the table below:

Grade	Minimum points
1.0	95
1.3	90
1.7	85
2.0	80
2.3	75
2.7	70
3.0	65
3.3	60
3.7	55
4.0	50
5.0	0

Conditions
None.

Learning Outcomes
Students

- aquire the system thinking worldview for economics
- utilize different methods and tools to map the structure of complex economic systems
- are able to relate dynamic effects to these structures
- learn how to simulate systems within the computer for testing purposes
- use simulation results to improve models
- can independently as well as in teams model, analyze, and optimize business processes and applications
- know how to offer business dynamics as a consulting service and work together with client teams

Content
Corporate growth, the diffusion of new technologies, business processes, project management, product development, service quality management — all these are examples for application areas of business dynamics. They all are dynamic systems that are characterized by feedback loops between many different variables. By means of the tools of business dynamics such systems can be modelled. Simulations of complex systems allow the analysis, the goal centered design, as well as the optimization of markets, business processes, policies, and organizations.

Workload
The total workload for this lecture will amount to approximately 135 hours (4.5 credits).

Activity		Workload
Attendance time		
Attendance of lecture	15 x 90min	22h 30m
Attendance of exercise	7 x 90min	10h 30m
Self-study		
Preparation of lecture		22h 30m
Wrap-up of lecture		22h 30m
Preparation of excercise		25h 00m
Preparation of assessment		31h 00m
Assessment		1h 00m
Sum		135h 00m

Media

- Slides
- System Dynamics Software Vensim PLE: http://www.vensim.com/venple.html

Literature
John D. Sterman. Business Dynamics: Systems Thinking and Modeling for a Complex World. McGraw-Hill, 2000.

Course: Business Plan Workshop [2572184]

Coordinators: M. Klarmann, O. Terzidis
Part of the modules: Marketing Management (p. 51)[WI4BWLMAR5], Entrepreneurship (EnTechnon) (p. 57)[WI4BWLENT1]

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

Learning Control / Examinations
See German version.

Conditions
None.

Learning Outcomes
See German version.

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

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

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

Course: Business Administration in Information Engineering and Management [2540500]

Coordinators: A. Geyer-Schulz
Part of the modules: Electronic Markets (p. 39)[WI4BWLISM2]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Summer term	de

Learning Control / Examinations

Assessment consists of a written exam of 1 hour length following §4 (2), 1 of the examination regulation and by submitting written papers as part of the exercise following §4 (2), 3 of the examination regulation.
The course is considered successfully taken, if at least 50 out of 100 points are acquired in the written exam. In this case, all additional points (up to 10) from excersise work will be added. The grades of this lecture are assigned following the table below:

Grade	Minimum points
1.0	95
1.3	90
1.7	85
2.0	80
2.3	75
2.7	70
3.0	65
3.3	60
3.7	55
4.0	50
5.0	0

Conditions

None.

Recommendations

Basic knowledge from Operations Research (linear programming) and from decision theory are expected.

Learning Outcomes

The student

- transfers models from Business Administration to situations in business whose basic conditions are changed due to the implementation of information and communication technology,
- applies methods from Business Administration (Decision theory, game theory, operations research, etc.) to questions of Information Engineering and Management,
- analyzes the potential to automize the decision making process in businesses by data bases,
- describes the process to extract relevant data for decision making from operational accounting systems.

Content

In this lecture, classical Business Administration is applied to businesses in an information- and communicationtechnological environment. The process to extract relevant data for decision making from operational accounting systems receives special attention. In order to do so, topics such as activity-based costing and transaction costs models are addressed. The automization of the decision making process in businesses by data bases is another focus of the module. To solve such issues within a company, relevant methods such as decision theory and game theory are lectured. Finally, complex business relevant questions in a dynamically changing environment are adressed by presenting models and methods from system dynamics.

Workload

The total workload for this lecture will amount to approximately 150 hours (5 credits).

Activity		**Workload**
Attendance time		
Attendance of lecture	15 x 90min	22h 30m
Attendance of exercise	7 x 90min	10h 30m
Preparation of lecture		17h 00m
Wrap-up of lecture		17h 00m
Preparation of excercise		42h 00m
Preparation of assessment		40h 00m
Assessment		1h 00m
Summe		150h 00m

Media
Slides, Audio.

Literature

- G. Bamberg und A. G. Coenenberg (2006). Betriebswirtschaftliche Entscheidungslehre. (13. edition), chapter 1 – 8, pages 1 – 270.
- Russell, S. and Norvig, P. (1995). Artificial Intelligence: A Modern Approach The Intelligent Agent Book. Prentice-Hall, Upper Saddle River. chapter 2, pages 31 – 37.
- Porter, M. E. (1998a). Competitive Advantage: Creating and Sustaining Superior Performance. The Free Press, New York, 2 edition. chapter 1, pages 1 – 30
- Porter, M. E. (1998b). Competitive Strategy: Techniques for Analyzing Industries and Competitors. The Free Press, New York, 2 edition. chapters 1+2, pages 1 – 46
- Horngren, C. T., Datar, S. M., and Foster, G. (2003). Cost Accounting: A Managerial Emphasis. Prentice-Hall, Upper Saddle River, 11 edition. chapter 13, pages 446 – 460
- Cooper,W.W., Seiford, L. M., and Tone, K. (2000). Data Envelopment Analysis. Kluwer Academic Publishers, Boston. chapter 2, pages 21– 25
- Copeland, T. and Weston, F. (1988). Financial Theory and Corporate Policy. Addison-Wesley, Reading, 3 edition. pages 18 – 41 and chapter 4.E, pages 92 – 95].
- Myerson, R. B. (1997). Game Theory. Harvard University Press, London, 3 edition. pages 99–105.
- Milgrom, P. and Roberts, J. (1992). Economics, Organization and Management. Prentice Hill [Chapter 2, pp. 25-39].

Course: CATIA CAD training course [2123356]

Coordinators: J. Ovtcharova
Part of the modules: Virtual Engineering B (p. 110)[WI4INGMB30]

ECTS Credits	Hours per week	Type	Term	Instruction language
2	2	practical course	Winter / Summer Term	de

Learning Control / Examinations
Practical examination, duration: 60 min., auxiliary means: script

Conditions
None.

Recommendations
Dealing with technical drawings is required.

Learning Outcomes
Students are able to create their own 3D geometric models in the CAD system, to generate drawings due to the created geometry and then carry out FE-studies and kinematic simulations using the integrated CAE tools. With advanced, knowledge-based functionalities of CATIA the participants will learn to automate the creation of geometry and thus to ensure the reusability of the models.

Content
The participant will learn the following knowledge:

- Basics of CATIA such as user interface, handling etc.
- Production and processing of different model types
- Production of basic geometries and parts
- Generation of detailed drawings
- Integration of partial solutions in modules
- Working with constrains
- Strength analysis with FEM
- Kinematic simulation with DMU
- Dealing with CATIA Knowledgeware

Workload
The total workload for this course is approximately 60 hours. For further information see German version.

Literature
practical course skript

Remarks
For the practical course attendance is compulsory.

Course: CAD-NX training course [2123355]

Coordinators: J. Ovtcharova
Part of the modules: Virtual Engineering B (p. 110)[WI4INGMB30]

ECTS Credits	Hours per week	Type	Term	Instruction language
2	2	practical course	Winter / Summer Term	de

Learning Control / Examinations
Practical examination, duration: 60 min., auxiliary means: script

Conditions
None

Recommendations
Dealing with technical drawings is required.

Learning Outcomes
Students are able to create their own 3D geometric models in the CAD system, to generate drawings due to the created geometry and then carry out FE-studies and kinematic simulations using the integrated CAE tools. With advanced, knowledge-based functionalities of NX the participants will learn to automate the creation of geometry and thus to ensure the reusability of the models.

Content
The participant will learn the following knowledge:

- Overview of the functional range
- Introduction to the work environment of NX
- Basics of 3D-CAD modelling
- Feature-based modelling
- Freeform modelling
- Generation of technical drawings
- Assembly modelling
- Finite element method (FEM) and multi-body simulation (MBS) with NX

Workload
The total workload for this module is approximately 60 hours. For further information see German version.

Literature
Practical course skript

Remarks
For the practical course compulsory attendance exists.

Course: Case Studies in Pricing [2572182]

Coordinators: M. Klarmann, Mitarbeiter
Part of the modules: Sales Management (p. 53)[WI4BWLMAR6], Services Marketing (p. 56)[WI4BWLMAR9]

ECTS Credits	Hours per week	Type	Term	Instruction language
1,5	1	other	Winter term	de

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
See German version.

Content
The students work in groups applying theories to solve case studies for price management.

Workload
The total workload for this course is approximately 45.0 hours. For further information see German version.

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

Course: Challenges in Supply Chain Management [2550494]

Coordinators: R. Blackburn
Part of the modules: Operations Research in Supply Chain Management and Health Care Management (p. 84)[WI4OR5]

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

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

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

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

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

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
To be defined depending on the topic.

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

Course: Chemical Technology of Water [22601]

Coordinators: H. Horn
Part of the modules: Water Chemistry and Water Technology I (p. 146)[WI4INGCV6]

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

Learning Control / Examinations
See module description.

Conditions
See corresponding module information.

Learning Outcomes
The student has a basic knowledge of water chemistry and knows the most important methods for the treatment of different raw waters for drinking and process water purposes.

Content
Water: hydrological cycle, physical and chemical characteristics, water as solvent, water hardness, Calcium-carbonate system, water treatment - part I (sieving, sedimentation, flotation, filtration, flocculation), water treatment - part II (adsorption, ion exchange, gas transfer, deacidification, softening, oxidation, disinfection), calulations.

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Literature
Elective literature:

- Crittenden, J. [Ed.]: Water Treatment. Principles and Design. 2nd ed. Wiley & Sons, 2005.
- DVGW: Wasseraufbereitung - Grundlagen und Verfahren. In: Lehr- und Handbuch Wasserversor-gung Bd.6. Oldenbourg Industrie-Verlag, 2004.
- Frimmel, F. H.: Wasser und Gewässer. Ein Hand-buch. Spektrum Verlag, 1999.
- Grohmann, A., Hässelbarth, U., Schwerdtfeger, W.(Hrsg.): Die Trinkwasserverordnung. 4. Auflage, E. Schmid, Berlin, 2002.
- Sigg,L., Stumm, W.: Aquatische Chemie. Eine Einführung in die Chemie wässriger Lösungen und natürlicher Gewässer. Verlag der Fachvereine Zürich, 1994.
- Stumm, W., Morgan, J. J.: Aquatic Chemistry. Chemical Equilibria and Rates in Natural Waters. 3rd ed. Wiley & Sons, 1996.

Remarks
The course will not be offered any more from winter term 2014/2015 on. The examination will be offered latest until summer term 2017 (repeaters only).

Course: Chemical, physical and material science aspects of plastics in the micro technology [2143500]

Coordinators: M. Worgull, D. Häringer
Part of the modules: Microfabrication (p. 118)[WI4INGMBIMT2]

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

Learning Control / Examinations
The assessment will consist of a oral exam (30 min) (following §4 (2), 2 of the examination regulation).

Conditions
None.

Recommendations
This Lecture can be combined with “Replication processes in micro technology” [2143893]
Intermediate examination or bachelor degree of mach/wing necessary.
Basic knowledge of the micro-system technology (but not a requirement) and interdisciplinary interest are favourable.

Learning Outcomes

Content

- **Introduction to the world of the plastics**
- **Chemistry of the polymers - synthesis and chemical characteristics**
- **Tailor-made composite / polymer blends**
- **Physical characteristics of plastics and their description**
  - Morphologic structure
  - Thermal behaviour
  - Time temperature - equivalence
  - Rheology of polymer melts
  - Thermo analysis
- **Plastics processing in the micro technology**
- **Application of polymers as construction material in the micro-system technology**
  - Composites / Compounds
  - MID – injection moulding of circuit carriers
  - Assembling and welding of plastics
  - Engineering with plastics
  - Environmental problems - biological degradable polymers
- **Meaning of the plastics in the micro technology explained by examples of current developments of polymer-based applications**
  - Semi conducting organic plastics
  - Nano-structured polymer surfaces
  - Polymer sensors (biologically, chemically, optically)

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Printouts of the lecture presentation, if applicable further scientific articles.

Course: Communication Systems and Protocols [23616 / 23618]

Coordinators: J. Leuthold, J. Becker, M. Hübner
Part of the modules: Optoelectronics and Optical Communication (p. 125)[WI4INGMBIMT6]

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

Learning Control / Examinations
The assessment consists of a written exam (120 minutes) (following §4(2), 1 of the examination regulation).

Conditions
None.

Recommendations
Mathematics of a bachelor.

Learning Outcomes
Students

- Will have a basic knowledge of protocols
- Will understand the purpose of layers

Knows the TCIP/IP protocol suite and can work and debug using a network analyzer program.

Content

- Communications Fundamentals: Analog/Digital Conversion, The Channel description in Time and Frequency, Channel Capacity, Transmission Media
- Modulation Formats(brief introduction)
- Networks and Layers: System Architecture, Network Layers, Layer Service Models, Peer-to-peer protocols, Medium Access Control Protocols, Repeater/Hub/Bridge/Switch/Router/Gateway
- Local Area Networks: Ethernet, Token-Ring, WiFi, WiMax, RPR
- Packet Switched Networks: Network Layer Categorization (Circuit-Switched Networks, Burst-Switched Networks, Packet-Switched Networks; Datagrams and Virtual Circuits; Routing
- TCP/IP: TCP/IP Archictecture, the IP protocol; UDP; TCP; IP; DNS
- Bus-Systems and Protocols
- Basics of transmitters and drivers
- System busses (I2C, V24)
- Peripheral busses (RS232, USB, Firewire)

Process busses (ASI, Profibus, CAN, LIN, FlexRay)

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Viewegraph & blackboard lecture.
Lecture notes will be handed out.

Remarks
This is a basic lecture and useful for all communications lectures.

Course: Communications Economics [2540462]

Coordinators: J. Kraemer
Part of the modules: Information Engineering (p. 44)[WI4BWLISM7]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise	Summer 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). 80% of the final grade is based on the written exam and 20% 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.

Recommendations
Formally, there are no prerequisites to visiting this class. The course is aimed at MA students with a solid background in economics, preferably, but not necessarily, in Industrial Organization. The course is complementary to the course *Telekommunikations- und Internetökonomie* [2561232] which is held in German and deals with more advanced topics in communications economics.

Learning Outcomes
The course will provide students with an introduction to the economic, technological and legal (regulatory) foundations of telecommunications markets. Moreover, students will get acquainted with current regulatory economic challenges, such as local loop unbundling, regulation of the Internet, or assignment of spectrum licenses.

Content
The lessons of this course include:

- The Demand of Telecommunications Services
- Technological and Economic Principles of Telecommunications Infrastructure
- Foundations of (Telecommunications) Regulation
- One-Way Access & Access Pricing
- Frequency Licenses and Spectrum Assignment
- The Economics and the Design of Telecommunications Tariffs
- The Economics of the Internet

Term Paper:
Each student is required to submit a short term paper (4 pages) on a current topic in telecommunications regulation. The topic will be presented in the first lecture and students have time for the remainder of the course to work on the term paper. The term paper is graded and accounts for 20% of the final grade.
Tutorials:
In addition, complementary tutorials will be held every two weeks. Exercise sheets will be submitted to the students in advance. Solutions to the exercises will be presented during the tutorials.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Aktivität		Arbeitsaufwand
Präsenzzeit		
Besuch der Vorlesung	15 x 90min	22h 30m
Besuch der Übung	15 x 45min	11h 15m
Vorbereitung der Vorlesung		19h 30m
Nachbereitung der Vorlesung		19h 30m
Vorbereitung der Übung		21h 00m
Vorbereitung der Prüfung		40h 15m
Prüfung		1h 00m
Summe		150h 00m

Media

- PowerPoint

- E-learning platform ILIAS

Literature

- J.-J. Laffont, J. Tirole (2000): *Competition in Telecommunications*, MIT Press.
- R. R. Braeutigam (1989): “Optimal Policies for Natural Monopolies” in: R. Schmalensee and R. Willig (eds.): *Handbook of Industrial Organization*, Vol. 2, Ch. 23, pp. 1289–1346, North-Holland
- Steger, U., Büdenbender, U., Feess, E., Nelles, D. (2008): *Die Regulierung elektrischer Netze: Offene Fragen und Lösungsansätze*, Springer
- Varian, Hal (2006): “Intermediate microeconomics: a modern approach”, 7th edition (international student edition), Norton

Remarks

The course will be offered latest until summer term 2014. The examination will be offered latest until winter term 2014/15 (repeaters only).

Course: Computational Economics [2590458]

Coordinators: P. Shukla, S. Caton
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Electives in Informatics (p. 82)[WI4INFO3], Informatics (p. 78)[WI4INFO1]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise	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.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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: Computational Risk and Asset Management [2530371]

Coordinators: M. Ulrich
Part of the modules: Computational Finance (p. 29)[WI4BWLFBV12]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	4	lecture	Winter term	en

Learning Control / Examinations
There will be an exam at the end of the lecture.

Conditions
The programming seminar “Solving Computational Risk and Asset Management Problems” has to be attended in the same semester.

Recommendations
None.

Learning Outcomes
This lecture teaches statistical, numerical and IT skills that are necessary to solve industry relevant asset management problems with novel academic methods. After successful completion of this lecture, student have acquired the following skills:
A) Statistical Machine Learning for predicting asset returns and risk densities
1. 'Supervised learning' with linear models: regression, maximum likelihood, Kalman Filter, VAR, impulse response analysis, causality
2. 'Supervised learning' with non-linear models: NLS, maximum likelihood, non-linear Kalman Filter, expectation maximization
3. Frequency and Bayesian way of estimating 'simple' asset pricing models
4. 'Unsupervised learning': PCA, SVD
B) Financial Concepts
1. CAPM, Fama-French and factor models to predict returns
2. Fama-MacBeth regressions to estimate risk premiums
3. Optimal portfolio allocation (Markowitz)
4. GARCH modeling to predict risk
5. Predicing interest rates
C) Essential numerical tool kit for
1. Determining fixed points
2. Finding roots
3. Simulating random numbers
4. Matrix inversion
5. Solving integrals and differential equations
6. Optimizing functions

Content
The lecture provides a hands-on introduction to the field of computational risk and asset management. It introduces statistical machine learning concepts and applies these to the prediction of stock and bond returns, risk densities and risk premiums. All necessary concepts will be introduced during the lecture.

Workload
The total workload for this course is approximately 135 hours. For further information see German version.

Remarks
The course is held in English.
The credits have been changed from 9 to 4,5.

Course: Corporate Financial Policy [2530214]

Coordinators: M. Ruckes
Part of the modules: Finance 3 (p. 28)[WI4BWLFBV11], Finance 2 (p. 27)[WI4BWLFBV2], Economic Theory and its Application in Finance (p. 71)[WI4VWL14], Applied Strategic Decisions (p. 63)[WI4VWL2]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
Students

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

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

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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 II (p. 32)[WI4BWLFBV7], Insurance Management I (p. 31)[WI4BWLFBV6]

ECTS Credits	Hours per week	Type	Term	Instruction language
2	2/0	lecture	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.

Workload
The total workload for this course is approximately 60 hours. For further information see German version.

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

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

Course: Customer Relationship Management [2540508]

Coordinators: A. Geyer-Schulz
Part of the modules: Advanced CRM (p. 37)[WI4BWLISM1]

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

Learning Control / Examinations
Assessment consists of a written exam of 1 hour length following §4 (2), 1 of the examination regulation and by submitting written papers as part of the exercise following §4 (2), 3 of the examination regulation.
The course is considered successfully taken, if at least 50 out of 100 points are acquired in the written exam. In this case, all additional points (up to 10) from excersise work will be added. The grades of this lecture are assigned following the table below:

Grade	Minimum points
1.0	95
1.3	90
1.7	85
2.0	80
2.3	75
2.7	70
3.0	65
3.3	60
3.7	55
4.0	50
5.0	0

Conditions
None.

Learning Outcomes
The students

- understand service management as an economic basis for Customer Relationship Management and learn the resulting consequences for the management, the organisation itself and their departments,
- design and develop service concepts and service systems at a conceptual level,
- work on case studies in the CRM-area in small groups with limit time,
- learn English as the technical language in the area of CRM and consult internationale literature from this field for the case studies.

Content
The course begins with an introduction into Service Management as the strategic concept which also covers all CRM applications. The course is divided in the basics of Service Management as well as different topics within this concept like external and internal marketing, quality management and organizational requirements.

Workload
The total workload for this course is approximately 135 hours (4.5 credits).
\begin{tabular}{lcr}
\hline
\textbf{Activity} & & \textbf{Workload} \\
\hline
Attendance time & & \\
Attendance of lecture & 15 x 90min & 22h 30m \\
Attendance of exercise & 7 x 90min & 10h 30m \\
\hline
Self-study & & \\
Preparation of lecture & & 22h 30m \\
Wrap-up of lecture & & 22h 30m \\
Preparation of excercise& & 25h 00m \\
Preparation of assessment & & 31h 00m \\
\hline
Assessment & & 1h 00m \\
\hline

\hline
Sum & & 135h 00m \\
\end{tabular}
The integration of learningoutcomes (Content (content), Skills (skills) with levels and the estimated workload for an average student is intended.

Media
Slides, Audio, Reader

Literature
Christian Grönroos. Service Management and Marketing : A Customer Relationship Management Approach. Wiley, Chichester, 2nd edition, 2000.
Elective literature:
Jill Dyché. The CRM Handbook: A Business Guide to Customer Relationship Management. Addison-Wesley, Boston, 2nd edition, 2002.
Ronald S. Swift. Accelerating Customer Relationships: Using CRM and RelationshipTechnologies. Prentice Hall, Upper Saddle River, 2001.
Stanley A. Brown. Customer Relationship Management: A Strategic Imperative in theWorld of E-Business. John Wiley, Toronto, 2000.

Course: Data Mining and Applications [2520375]

Coordinators: G. Nakhaeizadeh
Part of the modules: Econometrics and Statistics II (p. 92)[WI4STAT6], Econometrics and Statistics I (p. 91)[WI4STAT5], Statistical Methods in Risk Management (p. 89)[WI4STAT2]

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

Learning Control / Examinations

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

Conditions
None.

Learning Outcomes
After completing of the course the students:

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

Content
Part one: Data Mining
Why Data Mining?

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

Part two: Examples of application of Data Mining

- Success parameters of Data Mining Projects
- Application in industry

- Application in Commerce

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

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

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

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

Course: Database Systems and XML [2511202]

Coordinators: A. Oberweis
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Winter term	de

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

Conditions
None.

Learning Outcomes
Students

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

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

Workload
Warning: not a valid latex tabular environment.

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. 2009
- G. Vossen: Datenbankmodelle, Datenbanksprachen und Datenbankmanagementsysteme. Oldenbourg 2008

Course: Data Protection Law [24018]

Coordinators: G. Sydow
Part of the modules: Public Business Law (p. 154)[WI4JURA6], Governance, Risk & Compliance (p. 155)[WI4JURGRC]

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

Learning Control / Examinations
The assessment consists of an written exam (approx. 60 min.) according to § 4(2), 1 SPO.

Conditions
None.

Recommendations
Parallel to the lectures tutoria are offered in which legal thinking and argumentation is practised. Their attendance is strongly recommended.
During the semester, test exams to each lecture are offered with extensive coaching. During the lecture-free time, a Q-and-A-lecture is offered.Details on the homepage of the ZAR (www.kit.edu/zar)

Learning Outcomes
Increasing significance of information technology for data processing and interconnectedness of the society by means of telecommunication does not only enhance the social and economical relevance of data in general, it raises the question about legal rules for the protection of personalised data as well. The problem for those who are responsible for the application of law is that national rules in this area are in constant flux due to technological progress and Europeanisation of law. Additionally there is a vast number of sector-specific regulation (such as labour law). Bearing all this in mind, the lecture's main focus is the presentation of the basic principles of the German Federal Act on Data Protection (Bundesdatenschutzgesetz). In doing so, new concepts of data protection like self-data protection or system data protection will be analysed. A further focal point is the examination of evolution of sector-specific data protection law, considering as example regulation of data protection in connection with teleservice or mediaservice. Students should learn how to negotiate their ways in the interaction of different levels of legal norms and solve simple problems of data protection law.

Content
After illustrating contents and history of data protection law there will be presented backgrounds with respect to Community law and under constitutional law. Further on, the German Federal Act on Data Protection will be focussed. At this will be set forth basic principles of regulation (such as necessity), personalised data as an object of regulation, rights of those who are affected as well as the legitimacy of different procedures of data processing. Oranisational regulations, particularly data security official will be approached as well. Further on, in a case study current concepts of data protection and the problem of video surveillance will be discussed. Finally, there are three units on sector-specific regulation of telecommunication and teleservice / mediaservice.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
extensive script with cases; content structure, further information in the lectures

Literature
Will be announced in the course.
Elective literature:
Wil be announced in the course.

Remarks
In cooperation with the House of Competence, Students should be rhetorical trained asking and answering questions (short-answer-and-question-technique). Therefor most likely a coach will attend several lessons.

Course: Derivatives [2530550]

Coordinators: M. Uhrig-Homburg
Part of the modules: Finance 2 (p. 27)[WI4BWLFBV2], Finance 3 (p. 28)[WI4BWLFBV11], Finance 1 (p. 26)[WI4BWLFBV1]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise	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.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Slides, Exercises/Exercise sheets

Literature

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

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

Course: Design Thinking [2545010]

Coordinators: O. Terzidis, Dr. Kneisel, Dr. H. Haller, P. Nitschke
Part of the modules: Entrepreneurship (EnTechnon) (p. 57)[WI4BWLENT1], Innovation Management (p. 58)[WI4BWLENT2]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
Methods and tools of the Design Thinking approach will be learned and - more than that - actively practiced. This includes leaving class and work on hands on solutions.

Content
See German version.

Workload
Time of attendance: 30 hours
Studying at home: 30 hours
Exam preparation: 30 hours

Literature
See German version.

Remarks
The seminar content will be published on the website of the institute.

Course: Developing Business Models for the Semantic Web [2513305]

Coordinators: R. Studer, M. Maleshkova, F. Keppmann
Part of the modules: Entrepreneurship (EnTechnon) (p. 57)[WI4BWLENT1]

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

Learning Control / Examinations
Non exam assessment (seminar paper) (following §4(2), 3 of the examination regulation).

Conditions
None.

Recommendations
As a recommendation to attending the seminar, basic knowledge about semantic technologies and concepts should be available. This may be acquired by attending one of the following lectures – Wissensmanagement, Semantic Web Technologies 1, Semantic Web Technologies 2 or by studying related literature. Furthermore the topic entrepreneurship should be of interest.

Learning Outcomes
The Student

- analyzes and develops in small teams a business model from an idea to a complete business plan or
- treats a special topic from the area of Semantic Web in businesses and entrepreneurships.
- learns about basic concepts and problem areas and considers these while building the business plan for a particular business idea.
- understands and considers the viewpoints of different stakeholders in the area of entrepreneurships and their influences on an own business idea.

Content
Semantic technologies such as RDF, SPARQL, OWL, and RIF are still standardised only in their first versions. Still, the multitude of integrated technologies provides the basis for development of new applications and creates, with the help of the initial standardisations, a foundation for attracting investors. The potential and future developments in the field are exemplified by the growing popularity and importance of data, being published as Linked Data, as well as by the increase in applications developed outside the scope of research. The seminar "Developing Business Models for the Semantic Web" aims to explore these opportunities for new business models und business ventures.
The seminar takes place on a weekly basis and consists of two main parts. The first part is a series of presentations, held by external experts who share their experience in the area of entrepreneurship. The aim is to engage a wide variety of presenters, including applicants to programs for supporting young business ventures, startup founders, and people in leadership positions in established companies. Further guest lecturers include experts in the field of business and startup development, tax and enterprise law, as well as entrepreneurs, who have sold their startups or had to give up their ideas.
The second part consists of the contributions of seminar participants. They are required to develop a business model, starting with the initial idea and building it up to a complete business plan. This development process is accompanied by feedback sessions, pitches, mid-term presentations and a final presentation. The student presentations alternate with presentations given by external experts. Furthermore, besides on the development of a business plan, student can work on a specific topic such as "Analysing Existing Business Models on the Web" or "Using Open Source in Startups".
The seminar pass can be obtained by submitting a completed seminar thesis (i.e. the business plan or the specific topic) and by regularly attending the seminar presentations.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Document Management and Groupware Systems [2511212]

Coordinators: S. Klink
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2	lecture	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.

Workload
Workload: 120h overall,
Lecture 30h
Review and preparation of lectures 60h
Exam preparation 29h
Exam 1h

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: IT-based Road Design [6233901]

Coordinators: M. Zimmermann
Part of the modules: Safety, Computing and Law in Highway Engineering (p. 130)[WI4INGBGU9]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture + exercise	Winter term	de

Learning Control / Examinations
See module description.

Conditions
See corresponding module information.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: eEnergy: Markets, Services, Systems [2540464]

Coordinators: C. Weinhardt
Part of the modules: Information Engineering (p. 44)[WI4BWLISM7], Market Engineering (p. 41)[WI4BWLISM3], Energy Economics and Energy Markets (p. 49)[WI4BWLIIP4]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise	Summer 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 tasks and basic structure of the energy economy, in particular concerning electricity markets,
- understands the change in the energy economy and the necessity for the development of a Smart Grid,
- knows the market mechanisms in the energy market and their role in coordination and allocation of electric energy,
- is able to describe the relation between OTC, spot and balancing energy markets,
- knows the regulation specifications for energy markets and can reflect them critically,
- is able to model smart grid mechanisms and to evaluate them by simulation based methods.

Content
Scope of the lecture *eEnergy: Markets, Services, Systems* is economics and information management in energy markets. Integration of the growing number of renewable energy sources imposes new challenges on energy markets and the power system. To improve coordination between supply and demand it is necessary to interlink centralized and decentralized generators as well as consumers by means of ICT. Current electricity networks are extended by intelligent IT components thus incorporating the "Smart Grid". Existing market structures for electricity have to be adjusted for a successful implementation of demand side management and integration of an increasing number of renewable energy producers as well as electric vehicles. Apart from regulatory and economic concepts, methods for modeling and analysis of energy markets are introduced and explained during the course.
The lecture is structured as follows:

1. **Electricity Markets**
   Market Models, EEX (spot and futures market), OTC Trading, Market Coupling
2. **Regulation**
   Charges and Incentives, Network Congestion (Management)
3. **Demand Side Management**
   Smart Meters, Tariffs, Price Elasticity, Storage Systems, Electric Mobility
4. **Modeling and Analysis of Energy Markets**

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media

- PowerPoint
- E-learning platform ILIAS

Literature

- Erdmann G, Zweifel P. *Energieökonomik, Theorie und Anwendungen*. Berlin Heidelberg: Springer; 2007.
- Grimm V, Ockenfels A, Zoettl G. Strommarktdesign: Zur Ausgestaltung der Auktionsregeln an der EEX *. *Zeitschrift für Energiewirtschaft*. 2008:147-161.
- Stoft S. *Power System Economics: Designing Markets for Electricity*. IEEE; 2002.,
- Ströbele W, Pfaffenberger W, Heuterkes M. *Energiewirtschaft: Einführung in Theorie und Politik*. 2nd ed. München: Oldenbourg Verlag; 2010:349.

Remarks
The lecture has also been added in the IIP Module *Basics of Liberalised Energy Markets*.

Course: Efficient Energy Systems and Electric Mobility [2581006]

Coordinators: R. McKenna, P. Jochem
Part of the modules: Energy Economics and Technology (p. 50)[WI4BWLIIP5]

ECTS Credits	Hours per week	Type	Term	Instruction language
3,5	2/0	lecture	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.

Workload
The total workload for this course is approximately 105.0 hours. For further information see German version.

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

Literature
Will be anounced in the lecture.

Course: Efficient Algorithms [2511100]

Coordinators: H. Schmeck
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	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. The course covers algebraic problems like matrix multiplication, evaluation of polynomials, fast Fourier transformation as well as sorting and searching, computational geometry, and leader election in distributed algorithms.

Workload
The total workload for this course is approximately 150.0 hours. For further information see German version.

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: Market Engineering (p. 41)[WI4BWLISM3], Finance 3 (p. 28)[WI4BWLFBV11], Finance 2 (p. 27)[WI4BWLFBV2]

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

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

Conditions
None.

Learning Outcomes
The students

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

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media

- Powerpoint presentations
- recorded lecture available on the internet

Literature

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

Elective literature:

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

Course: Characteristics of Transportation Systems [6232806]

Coordinators: P. Vortisch
Part of the modules: Fundamentals of Transportation (p. 133)[WI4INGBGU15]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

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

Conditions
See module description.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Power Network Analysis [23371/23373]

Coordinators: T. Leibfried
Part of the modules: Generation and transmission of renewable power (p. 143)[WI4INGETIT7]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	2/2	lecture + exercise	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam (120 min) taking place at the beginning of the recess period (according to Section 4 (2), 1 of the examination regulation). The exam takes place in every winter semester. Re-examinations are offered at every ordinary examination date.

Conditions
See German version.

Learning Outcomes
The students are able to do calculations of load flows and short-circuit current calculations in the electric power network. They know the equivalent electric circuit of the equipment and the mathematics of the calculation methods, be it for symmetrical or asymmetrical networks.

Content
In its first part, this lecture introduces the High-Voltage technology and its basics. Especially, the reasons for the necessity for the power transmission with high voltages are given. Basic electrical configurations and stresses occurring at multi dielectric systems are presented. Finally the first chapter deals with discharge phenomena.
The second chapter deals with the three phase system. Especially, the mathematical treatment of three phase systems and the introduction of component systems are contained in this chapter.
The third and very comprehensive chapter deals with the transmission and distribution of electric energy. Firstly, the laws of power transmission via transmission lines are presented. Then, the stability of electric power systems and possibilities to increase the power transmission capacity are discussed. Finally, the physics of energy distribution in the medium and low voltage grid is shown.
The fourth chapter deals with the Calculation of electric power networks and systems. Firstly, the preparatory steps for the calculation of the power network are shown. After discussing the basic network analysis methods, the load flow calculation are shown. Especially, the method of current iteration and the Newton Raphson method are presented and the algorithms of the individual methods are shown using an example.
The fifth chapter deals with methods for the calculation of the 3 phase short circuit. Thereby, it is distinguished between the short circuit nearby the generator and far from the generator.
In the sixth chapter the unsymmetrical faults in power networks and their calculation are discussed. Therefore, the symmetrical components are introduced as a first step. Then, the circuits in symmetrical components of all important power network equipment are presented. The chapter closes with the mathematical treatment of unsymmetrical short circuits using the symmetrical component method.
To accompany the lecture, a collection of problems can be downloaded. During lecture hall exercises their solutions will be discussed.

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

Media
Online material is available on: https://www.ieh.kit.edu/studium_und_lehre_bee.php and can be downloaded using a password.

Literature
Elective literature:
Will be announced in the lecture notes.

Remarks
The title of this course has been changed. Former name: Power Network Analysis (until SS2014).

Course: Electric Rail Vehicles [2114346]

Coordinators: P. Gratzfeld
Part of the modules: Track Guided Transport Systems / Engineering (p. 138)[WI4INGBGU27]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
The assessment will consist of a oral exam (20 min) according to §4 (2), 2 of the examination regulation.
The exam is offered each semester. The re-examination is offered upon prior agreement with the interested participants and not later than the next regular examination date.

Conditions
See module description.

Recommendations
none

Learning Outcomes
The students know the history of electric traction in railway transportation from the very beginning to modern vehicles with three-phase traction drives.
They know the basics of railway transportation, vehicle dynamics and wheel-rail-contact and can deduct the requirements for electric rail vehicles out of it.
They understand purpose, design and functionality of electric traction drives.
They learn about the different systems of traction power supply with its advantages and disadvantages.
They are informed about actual concepts and new developments in the field of electric railway vehicles.

Content
History of electric traction with railway vehicles, economic impact
Vehicle dynamics: running resistance, tractive effort diagram, running cycles
Wheel-rail-contact
Electric drives: traction motors, power conversion, drives for vehicles at dc and ac lines, dieselelectric vehicles, multi system vehicles, axle drives, transmission of tractive effort to the rails
Traction power supply: networks, substations, inductive power supply, energy management
Modern vehicle concepts for mass transit and main line

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
All slides are available for download (Ilias-platform).

Literature
A bibliography is available for download (Ilias-platform).

Course: Elements of Technical Logistics [2117096]

Coordinators: M. Mittwollen, Madzharov
Part of the modules: Technical Logistics (p. 106)[WI4INGMB27], Introduction to Logistics (p. 99)[WI4INGMB20]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	3	lecture + exercise	Winter term	de

Learning Control / Examinations
after each lesson period; oral / written (if necessary) => (look at “Studienplan Maschinenbau”, latest version)

Conditions
None.

Recommendations
previous / parallel visit of LV 21177095 “Grundlagen der Technischen Logistik”

Learning Outcomes
Students are able to:

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

Content
material flow systems and their (conveying) technical components
mechanical behaviour of conveyors;
structure and function of conveyor machines; elements of intralogistics (belt conveyor, racks, automatic guided vehicles, fan-in, bifurcation, and etc.)
sample applications and calculations in addition to the lectures inside practical lectures

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Media
supplementary sheets,projector, blackboard

Literature
recommendations during lectures

Course: Elements of Technical Logistics and Project [2117097]

Coordinators: M. Mittwollen, Madzharov
Part of the modules: Technical Logistics (p. 106)[WI4INGMB27], Introduction to Logistics (p. 99)[WI4INGMB20]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	4	lecture + exercise	Winter term	de

Learning Control / Examinations
Lesson: after each lesson period; oral / written (if necessary) => (look at "Studienplan Maschinenbau"); (counts two-thirds); Project: presentation, marked (counts one third)

Conditions
None.

Recommendations
previous / parallel visit of LV 21177095 "Grundlagen der Technischen Logistik"

Learning Outcomes
Students are able to:

- Describe elements and systems of technical logistics,
- Model and calculate structures and functions of special conveying machines,
- Describe interdependence of material flow systems and technique quantitatively and qualitatively,
- Equip material flow systems with appropriate machines and
- Judge about systems in place and justify it in front of subject related persons.

Content
mechanical behaviour of conveyors;
structure and function of conveyor machines; elements of intralogistics (belt conveyor, racks, automatic guided vehicles, fan-in, bifurcation, and etc.)
sample applications and calculations in addition to the lectures inside practical lectures
Self manufacturing of a project report to recesses the topic.

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

Media
supplementary sheets,projector, blackboard

Literature
recommendations during lectures

Course: Emissions into the Environment [2581962]

Coordinators: U. Karl
Part of the modules: Industrial Production II (p. 45)[WI4BWLIIP2]

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

Learning Control / Examinations
The assessment consists of an oral (30 minutes) or a written (60 minutes) exam (following §4(2), 1 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Learning Outcomes
The student should identify problems of industrial pollution control.
The student knows solutions to these problems and their ways of application.

Content
The course will provide an overview of sources of air pollution, waste and municipal waste; methods to monitor and to reduce/manage pollutant flows; regulatory framework on national and international level.
A Air pollution control

- Indtroduction and definitions
- Sources an dpoluutants
- Regulatory framework
- Emission monitoring
- Air pollution control measures

B Waste management and Recycling

- Introduction and regulatory framework
- Statistics and logistics
- Recycling and disposal
- Waste treatment

C Waste water treatment

- Municipal waste water treatment systems
- Sewage sludge disposal

Workload
The total workload for this course is approximately 105 hours. For further information see German version.

Media
Media will be provided on learning platform.

Literature
Will be announced in thecourse.

Course: Transportation Data Analysis [6232901]

Coordinators: M. Kagerbauer
Part of the modules: Transportation Modelling and Traffic Management (p. 134)[WI4INGBGU16]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture + exercise	Winter term	de

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

Conditions
See module description.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Emulsifying and Dispersing [22229]

Coordinators: Köhler
Part of the modules: Specialization in Food Process Engineering (p. 145)[WI4INGCV4]

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

Learning Control / Examinations
The assessment consists of an oral exam (25 min) (according to §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.

Recommendations
None.

Learning Outcomes
The student

- Knows product categories in which emulsifying and dispersion technologies are applied and can give reasons for it.
- knows and understands the basic unit operations and processes found in emulsion/dispersion production. He/she is able to understand and explain the influence of different process parameters on product quality.
- Knows different processes used in industrial production of emulsions and dispersions. He/she knows and understands how they work and is able to explain disruption and stabilization principles found. He/she is able to choose an adequate process and explain the relevance of processing parameters for a given product and is able to explain his/her choice.

Content
The lecture “emulsifying and dispersing” has the target to introduce the two basic operations of chemical engineering and to show how they are used today. Contents of the lectures are the definitions of the basic concepts, introduction to the mechanisms, presentation of representative machines for the production of dispersions, visit the pilot plant, identification of criteria for choosing the right equipment, introduction to current research topics in the field of emulsifying and dispersing.

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Course: Theory of endogenous growth [2561503]

Coordinators: I. Ott
Part of the modules: Growth and Agglomeration (p. 69)[WI4VWL12], Innovation and growth (p. 75)[WI4VWLIWW1], Macroeconomic Theory (p. 67)[WI4VWL8]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise	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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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: Environmental Economics (p. 66)[WI4VWL5], Energy Economics and Technology (p. 50)[WI4BWLIIP5]

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

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

Conditions
None.

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

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

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Course: Energy and Process Technology I [2157961]

Coordinators: H. Bauer, A. Velji, H. Wirbser, C. Höfler
Part of the modules: Energy and Process Technology I (p. 126)[WI4INGMBITS1]

ECTS Credits	Hours per week	Type	Term	Instruction language
9	4/2	lecture + exercise	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam (120 minutes) (following §4(2), 1 of the examination regulation).

Conditions
None.

Recommendations
None.

Learning Outcomes
The students are able to:

- describe and calculate the basic physical-technical processes
- apply the mathematical and thermodynamical description
- reflect on and explain the diagrams and schematics
- comment on diagrams
- explain the functionality of gas and steam turbines and their components
- name the applications of thermal turbomachinery and their role in the field of electricity generation and propulsion technology

Content
The last thrid of the lecture deals with the topic **Thermal Turbomachinery**. The basic principles, the functionality and the scope of application of gas and steam tubrines for the generation of electrical power and propulsion technology are addressed.

Workload
The total workload for this course is approximately 270 hours. For further information see German version.

Course: Energy and Process Technology II [2170832]

Coordinators: C. Höfler, H. Wirbser
Part of the modules: Energy and Process Technology II (p. 127)[WI4INGMBITS2]

ECTS Credits	Hours per week	Type	Term	Instruction language
9	4/2	lecture + exercise	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (120 minutes) (following §4(2), 1 of the examination regulation).

Conditions
None.

Learning Outcomes
The students are able to:

- discuss and evaluate energy resources and reserves and their utility
- review the use of energy carriers for electrical power generation
- explain the concepts and properties of power-heat cogeneration, renewable energy conversion and fuel cells and their fields of application
- comment on and compare centralized and decentralized supply concepts
- calculate the potentials, riskis and economic feasibility of different strategies aiming at the protection of resources and the reduction of CO2 emissions
- name and judge on the options for solar energy utilization
- discuss the potential of geothermal energy and its utilization

Content
Thermal Turbomaschinery - In the first part of the lecture deals with energy systems. Questions regarding global energy resources and their use, especially for the generation and provision of electrical energy, are addressed. Common fossile and nuclear power plants for the centralized supply with electrical power as well as concepts of power-heat cogeneration for the decentralized electrical power supply by means of block-unit heat and power plants, etc. are discussed. Moreover, the characteristics and the potential of renewable energy conversion concepts, such as wind and hydro-power, photovoltaics, solar heat, geothermal energy and fuel cells are compare and evaluated. The focus is on the description of the potentials, the risks and the economic feasibility of the different strategies aimed to protect resources and reduce CO2 emissions.

Workload
The total workload for this course is approximately 270 hours. For further information see German version.

Course: Energy efficient intralogistic systems [2117500]

Coordinators: F. Schönung, M. Braun
Part of the modules: Technical Logistics (p. 106)[WI4INGMB27], Introduction to Logistics (p. 99)[WI4INGMB20]

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

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

Conditions
None.

Recommendations
Knowledge of Electrical Engineering and Technical Mechanics is recommended.

Learning Outcomes
Students are able to:

- Describe and choose basic measures to enhance energy efficency,
- Specify this measures considering material handling processes like
  - steady conveyors,
  - unsteady conveyors,
  - as well as the necassary drives,
- Model based on this material handling systems and calculate their energy efficiency and
- Choose ressource efficient material handling systems.

Content
The main focuses of the course are:

- green supply chain
- processes in Intralogistic systems
- evaluation of energy consumption of conveyors
- modeling of conveying systems
- methods for energy savings
- approaches for energy efficiency increasing of continuous and discontinuous conveyors
- dimensioning energy efficient drives
- new approaches for resource efficient conveying systems.

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
presentations, black board

Literature
None.

Remarks
none

Course: Energy Trade and Risk Management [2581020]

Coordinators: W. Fichtner, D. Keles, C. Cremer
Part of the modules: Energy Economics and Energy Markets (p. 49)[WI4BWLIIP4]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	3	lecture	Summer term	de

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

Conditions
None.

Learning Outcomes
The student

- has acquired a broad understanding of the different energy commodity markets (power, emissions, gas, oil, hard coal)
- knows the major products traded on the relevant energy commodity markets
- has a deep understanding of pricing mechanisms on these markets
- knows the major evaluation methods from financial mathematics being able to be used for evaluating energy commodity products
- knows the key risk evaluation methods of energy commodity trading (VaR, CVaR, . . .).

Content

1. Introduction to Markets, Mechanisms, Interactions
2. Basics of Risk Management
3. Oil Markets
4. Gas Markets
5. Coal Markets
6. Emission Markets
7. Simulation Game
8. Power Markets
9. Risk Management in Utilities

Workload
The total workload for this course is approximately 120.0 hours. For further information see German version.

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

Literature
Elective literature:
Burger, M., Graeber, B., Schindlmayr, G. (2007): *Managing energy risk: An integrated view on power and other energy markets*, Wiley&Sons, Chichester, England
EEX (2010): *Einführung in den Börsenhandel an der EEX auf Xetra und Eurex*, www.eex.de
Erdmann, G., Zweifel, P. (2008), Energieökonomik, Theorie und Anwendungen, Springer, ISBN: 978-3-540-71698-3
Hull, J.C. (2006): *Options, Futures and other Derivatives*, 6. Edition, Pearson Prentice Hall, New Jersey, USA
Borchert, J., Schlemm, R., Korth, S. (2006): *Stromhandel: Institutionen, Marktmodelle, Pricing und Risikomanagement (Gebundene Ausgabe)*, Schäffer-Poeschel Verlag
www.riskglossary.com

Remarks
The credits have been changed from 3.5 to 4.

Course: Energy Policy [2581959]

Coordinators: M. Wietschel
Part of the modules: Energy Economics and Energy Markets (p. 49)[WI4BWLIIP4]

ECTS Credits	Hours per week	Type	Term	Instruction language
3,5	2/0	lecture	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 in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Learning Outcomes
See German version.

Content
The course deals with material and energy policy of policy makers and includes the effects of such policies on the economy as well as the involvement of industrial and other stakeholders in the policy design. At the beginning the neoclassical environment policy is discussed. Afterwards the Sustainable Development concept is presented and strategies how to translate the concept in policy decision follows. In the next part of the course an overview about the different environmental instruments classes, evaluation criteria for these instruments and examples of environmental instruments like taxes or certificates will be discussed. The final part deals with implementation strategies of material and energy policy.

Workload
The total workload for this course is approximately 105.0 hours. For further information see German version.

Literature
Will be anounced in the lecture.

Course: Power Transmission and Power Network Control [23372/23374]

Coordinators: T. Leibfried
Part of the modules: Generation and transmission of renewable power (p. 143)[WI4INGETIT7]

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

Learning Control / Examinations
The assessment consists of a written exam (120 min) taking place at the beginning of the recess period (according to Section 4 (2), 1 of the examination regulation). The exam takes place in every summer semester. Re-examinations are offered at every ordinary examination date.

Conditions
See German version.

Learning Outcomes
Students know the mode of operation and the physical specification of power transmission systems with three-phase current (HVAC) and direct-current (HVDC). They are able to
calculate transfer characteristics and to do a basic design. Furthermore they know the power grid control functionality.

Content
In its first part, this lecture introduces the dynamic behaviour of synchronous generators and the mathematical description.
In a first step, the construction of synchronous generators is described. Then, the dq0 frame and its application for the mathematical description of the dynamic behaviour of synchronous generators is presented. Subsequently, the transition from the common mathematical description of synchronous generators towards the equations describing the steady
state condition is shown. Then, transients are discussed at the example of a 60 Hz synchronous generator. Finally, the short circuit nearby the generator using the dq0 frame is discussed.
The second chapter deals with the HVDC technology. First of all, the characteristics of HVDC for power transmission are discussed. Then, line commutated current converters are introduced, especially the B6 circuit and 12 pulse current converters consisting of two B6 circuits switched in series are discussed. Then, the HVDC system configuration and components like filters, thyristors, smoothing reactors and converter transformers are presented. Finally, the basic control concept for HVDC transmission systems is shown.
The third and very comprehensive chapter deals with the technology and characteristics of FACTS, which can be used to increase the flexibility and the transmission capacity of power transmission systems. First of all the fields of application of FACTS are described. Then, the individual FACTS circuits and their mathematical description are presented, which can be divided into FACTS switched in series and parallel to the grid.
The fourth chapter deals with the dynamic behaviour of power stations and power grids. In the first part of the chapter, the system control modeling of power stations and power grids is presented. Then, the causes of frequency and voltage deviations in the grid are discussed. The main part of the chapter deals with the frequency control in the power grid. Finally, the voltage control of the power grid is presented.
To accompany the lecture, a collection of problems can be downloaded. During lecture hall exercises their solutions will be discussed.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Online material is available on: https://www.ieh.kit.edu/studium_und_lehre_euen.php and can be downloaded using a password.

Literature
Will be announced in the lecture notes.

Course: Energy Conversion and Increased Efficiency in Internal Combustion Engines [2133121]

Coordinators: T. Koch, H. Kubach
Part of the modules: Combustion Engines I (p. 97)[WI4INGMB34]

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

Learning Control / Examinations
See module description.

Conditions
None.

Recommendations
None.

Learning Outcomes
The students can name all important influences on the combustion process. They can analyse and evaluate the engine process considering efficiency, emissions and potential.

Content
1. Introduction
2. Thermodynamics of combustion engines
3. Fundamentals
4. gas exchange
5. Flow field
6. Wall heat losses
7. Combustion in gasoline engines
8. APR und DVA
9. Combustion in Diesel engines
10. Emissions
11. Waste heat recovery
12. Measures to increase efficiency

Workload
regular attendance: 24 hours, self-study: 96 hours

Remarks
This course was formerly named “Thermodynamics and Energy Conversion in Internal Combustion Engines”.

Course: Energy Systems Analysis [2581002]

Coordinators: V. Bertsch
Part of the modules: Energy Economics and Technology (p. 50)[WI4BWLIIP5]

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

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

Conditions
None.

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

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

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

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: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	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)

Workload

Activity		h
Lecture	(15 x 2 x 45 min)	22h 30min
Exercise	(15 x 1 x 45 min)	11h 15min
Preparation of exercises	(15 x 3h)	45 h
Script repetition (2x)	(2 x 15h)	30h
Calculation of 5 exams	(5 x 1h 15 min)	6 h 15 min
Exam preparation		35 h
Sum:		150 h

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: Entrepreneurial Leadership & Innovation Management [2545012]

Coordinators: O. Terzidis, C. Linz
Part of the modules: Entrepreneurship (EnTechnon) (p. 57)[WI4BWLENT1], Innovation Management (p. 58)[WI4BWLENT2]

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

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
- Seize what determines entrepreneurial performance
- Identify entrepreneurial opportunities and evaluate them
- Develop and sharpen innovative business ideas
- Pitch a business idea in front of potential share-/stakeholders
- Lead new business growth by driving the enterprise evolution
- Effectively deal with critical challenges and overcome obstacles

Content
On campus the seminar combines foundational knowledge, real-world examples, and practical exercise/group work sessions.

Workload
Time of attendance: 30 hours
Studying at home: 30 hours
Exam preparation: 30 hours

Course: Entrepreneurship [2545001]

Coordinators: O. Terzidis
Part of the modules: Entrepreneurship (EnTechnon) (p. 57)[WI4BWLENT1], Innovation Management (p. 58)[WI4BWLENT2]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Winter / Summer 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
Students are generally introduced to the topic of entrepreneurship. After successful completion of the lecture they should have an overview of the sub-areas of entrepreneurship and have to be able to understand basic concepts of entrepreneurship.

Content
This lecture, as an obligatory part of the module "Entrepreneurship", introduces basic concepts of entrepreneurship. It approaches the individual steps of dynamic corporate development. The focus here is the introduction to methods for generating innovative business ideas, the translation of patents into business concepts and general principles of financial planning.
Other topics are the design and use of service-oriented information systems for founders, technology management, business model generation and lean startup methods for the implementation of business ideas in the way of controlled experiments in the market.

In addition to the lectures the KIT Entrepreneurship Talks, where successful entrepreneurs share their experiences from the early stages of their companies, will be given. Dates and times will be announced in time on the EnTechnon website.

More details: http://etm.entechnon.kit.edu/211.php

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Entrepreneurship Research [2545002]

Coordinators: O. Terzidis, Mitarbeiter
Part of the modules: Entrepreneurship (EnTechnon) (p. 57)[WI4BWLENT1]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar	Summer term	de

Learning Control / Examinations
The performance review is done via a so called other methods of performance review (term paper) according to §4 (2), 3 SPO. The final grade is a result from both, the grade of the term paper and its presentation, as well as active participation during the seminar.

Conditions
None.

Recommendations
None.

Learning Outcomes
The students will work on a specific topic of Entrepreneurship Research. In their term paper, the chosen topic needs to be presented to scientific standards in written format on 15-20 pages. The results of the term paper will be presented during a block period seminar at the end of the semester (20 min presentation, 10 min discussion).
By writing the term paper, basic skills of autonomous scientific work, such as looking for literature, argumentation + discussion, citation and using qualitative, quantitative and simulative methods get trained. The term paper is therefore a preparation for the master thesis. For this reason the seminar is mainly for students that intend to write their master thesis at the Chair of Entrepreneurship and Technology Management.

Content
Content of the seminar is most recently discussed topics in the field of entrepreneurship. Topics and dates will be communicated online via the seminar portal.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Will be announced during/prior to the seminar as this varies from topic to topic.

Remarks
The topics will be prepared in groups. The presentation of the results is done during a a block period seminar at the end of the semester. Students have to be present all day long during the seminar.

Course: Design and Construction of Highways [6233801]

Coordinators: R. Roos
Part of the modules: Design, Construction, Operation and Maintenance of Highways (p. 128)[WI4INGBGU1], Highway Engineering (p. 129)[WI4INGBGU2]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture + exercise	Summer term	de

Learning Control / Examinations
See module description.

Conditions
See corresponding module information.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Operation Methods for Earthmoving [6241913]

Coordinators: H. Schlick
Part of the modules: Process Engineering in Construction (p. 135)[WI4INGBGU22]

ECTS Credits	Hours per week	Type	Term	Instruction language
1,5	1	lecture	Winter term	de

Learning Control / Examinations
The assessment consists of an oral exam (15 min.) taking place in the recess period (according to §4 (2), 2 of the examination regulation).

Conditions
None.

Learning Outcomes
Students

- Gain specific knowledge regarding construction methods and equipment
- Can determine appropriate equipment and they can plan construction methods
- Can evaluate different construction methods and construction equipment based on context of use.

Content
The lecture comprises

- Operational characteristics of equipment and driving dynamics of construction equipment
- Impact of boundary conditions on operational characteristics
- Mode of operation of construction equipment and systems of construction equipment.

Workload
The total workload for this course is approximately 45.0 hours. For further information see German version.

Media
Lecture slides.

Course: Gas-Markets [2581022]

Coordinators: A. Pustisek
Part of the modules: Energy Economics and Energy Markets (p. 49)[WI4BWLIIP4]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2/0	lecture	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

- Technical and economic principles of the natural gas industry
- Assessment of natural gas as energetic source
- Classification and assessment of the natural gas industry in a political and economic context
- Assessment of decisions, actions taken and consequences thereof in the natural gas industry
- Recognition, assessment and valuation of interdependencies between different energy markets
- Development of a qualified market view for natural gas markets

Content

- Introduction and principles
  - Definition and composition of natural gas
  - Main physical parameters of natural gas
  - The natural gas value chain and its interdependencies to other fuels
- Natural gas markets
  - Brief overview of sources and production (incl. shale gas)
  - Worldwide reserves of natural gas
  - Worldwide and European natural gas production and consumption
  - Natural gas market structure in Europe and Germany (incl. the role of hubs)
  - European and German energy (esp. natural gas) prices and their development
  - Parameters not harmonized in European natural gas markets and consequences thereof
- Natural gas (commodity) contracts
  - The impact of the market structure modification to contract structure
  - Main elements of natural gas purchase and sales contracts
  - General comparison of traditional and market based pricing
- Natural gas transportation
  - Technical description of pipeline transportation
  - Historical development of the European natural gas (pipeline) transportation system (incl. new projects)
  - LNG transportation
  - Comparison of LNG and pipeline transportation
  - Main elements of natural gas transportation contracts
  - Costs of natural gas transportation
  - Natural gas transportation pricing systems
  - Transportation capacity trading
- Natural gas storage
  - Storage functions and parameters
  - Technical description of natural gas storages

  - Storage types
  - Natural gas storage in Europe
  - Main elements of natural gas storage contracts
  - Costs of storage
  - Natural gas storage pricing
- Special topics
  - Selected aspects of regulation and legislation relevant for the natural gas industry
  - Portfolio management and risk management in the natural gas industry
  - „Gas-to-Liquids“ – technical description and economic impact
  - Brief overview of revenue management applied in the natural gas industry
  - Brief overview of bio-methane and its impact to natural gas markets in Germany

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

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

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

Coordinators: S. Nickel, S. Spieckermann
Part of the modules: Operations Research in Supply Chain Management and Health Care Management (p. 84)[WI4OR5]

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

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

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

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

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

Learning Outcomes
The student

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

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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: Economic integration in Europe [2561257]

Coordinators: J. Kowalski
Part of the modules: Economic Policy II (p. 64)[WI4VWL3]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
The student acquires profound knowledge of the EU historical development, EU institutional framework and the rules of the game, the evolution and the functioning of the EU decision-making mechanisms. They are able to form their own jugement on the complex Programmes, activities and conflict potentials in the EU.

Content

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Elective literature:
Baldwin, R./ Wyplosz, M.: “The economics of European Integration“ Mcgraw-Hill 2006, 2nd Edition
Pelkmans, J.: “European Integration - Methods and Economic Analysis”. Pearson Education 3rd Edition, 2006.

Remarks
The examination will be offered latest until summer term 2016 (repeaters only).

Course: European and International Law [24666]

Coordinators: G. Sydow
Part of the modules: Public Business Law (p. 154)[WI4JURA6]

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

Learning Control / Examinations
The assessment consists of an written exam (approx. 60 min.) according to § 4(2), 1 SPO.

Conditions
None.

Recommendations
Parallel to the lectures tutoria are offered in which legal thinking and argumentation is practised. Their attendance is strongly recommended.
During the semester, test exams to each lecture are offered with extensive coaching. During the lecture-free time, a Q-and-A-lecture is offered.Details on the homepage of the ZAR (www.kit.edu/zar)

Learning Outcomes
Due to the Europeanization of national law, the examination of European law is indispensable for everyone aiming to gain basic legal knowledge. Hardly any national activity can be imagined without the consideration of presetting of European Community law. By comparison, the influence of international law is of small importance. In light of this, the lecture predominantly deals with European law and imparts the knowledge of the EU law necessary for the students in order to comprehend how the national law is being covered by European Community law defaults. Afterwards, the student should be able to solve questions regarding European legislation in a problem-oriented manner. As the subject matter partly will be acquired in discourse with the students, it is necessary to acquire a corpus juris (e.g. Beck-Texte “Europarecht”).

Content
The lecture predominantly deals with the European law: in the origin, this contains an analysis of history from the EEC to EC and EU, of participants (parliament, commission, council, European Court of Justice), of sources of law (regulations, directives, final judgements, opinions, recommendations) and legislative procedure. Further, the lecture focuses on the basic liberties of the EC, which enable a free flow of goods (for example of beer not matching the German purity law), persons (like the professional footballer Bosman), services (like entrepreneurial activities) and capital. In addition, the charter of fundamental rights of the EC and the rules of competition will be discussed, in each case in the light of a concrete legal case. Moreover, the fundamental rights of the European Convention on Human Rights (ECHR) are being introduced. Concluding, a short survey of international law, especially of the World Trade Organization (WTO), will be given.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
extensive script with cases; content structure, further information in the lectures

Literature
Further details will be announced in the lecture.
Elective literature:
Further details will be announced in the lecture.

Course: Experimental Economics [2540489]

Coordinators: C. Weinhardt, T. Teubner
Part of the modules: Applied Strategic Decisions (p. 63)[WI4VWL2], Market Engineering (p. 41)[WI4BWLISM3], Experimental Economics (p. 74)[WI4VWL17]

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

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

Conditions
See corresponding module information.

Learning Outcomes
The students should learn

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

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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.

Course: Welding Lab Course, in groupes [2173560]

Coordinators: J. Hoffmeister
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	3	practical course	Winter term	de

Learning Control / Examinations
The assessment consists of a written report at the end of the experimental lab (according to Section 4(2), 3 of the examination regulation).

Conditions
The participation in the course *Welding Technology I/II* [21565/21570] is assumed.

Learning Outcomes
The students are capable to name a survey of current welding processes and their suitability for joining different metals. The students can evaluate the advantages and disadvantages of the individual procedures. The students have weld with different welding processes.

Content
Gas welding of steels with different weld geometries

Gas welding of cast iron, nonferrous metals

Brazing of aluminum

Electric arc welding with different weld geometries

Gas welding according to the TIG, MIG and MAG procedures

Workload
regular attendance: 31,5 hours
preparation: 8,5 hours
lab report: 80 hours

Literature
distributed during the lab attendance

Remarks
The lab takes place at the beginning of the winter semester break once a year. The registration is possible during the lecture period in the secretariat of the Institute of Applied Materials (IAM – WK). The lab is carried out in the Handwerkskammer Karlsruhe.
You need sturdy shoes and long clothes!

Course: Handling Characteristics of Motor Vehicles I [2113807]

Coordinators: H. Unrau
Part of the modules: Handling Characteristics of Motor Vehicles (p. 94)[WI4INGMB6]

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

Learning Control / Examinations
The assessment consists of an oral exam (30-40 min) taking place in the recess period and in the lecture period (according to §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.

Recommendations
It is recommended to attend the course *Basics of Automotive Engineering I and II* [2113805 and 2114835] beforehand.

Learning Outcomes
The students know the basic connections between drivers, vehicles and environment. They can build up a vehicle simulation model, with which forces of inertia, aerodynamic forces and tyre forces as well as the appropriate moments are considered. They have proper knowledge in the area of tyre characteristics, since a special meaning comes to the tire behavior during driving dynamics simulation. Consequently they are ready to analyze the most importent influencing factors on the driving behaviour and to contribute to the optimization of the handling characteristics.

Content
1. Problem definition: Control loop driver - vehicle - environment (e.g. coordinate systems, modes of motion of the car body and the wheels)

2. Simulation models: Creation from motion equations (method according to D'Alembert, method according to Lagrange, programme packages for automatically producing of simulation equations), model for handling characteristics (task, motion equations)

3. Tyre behavior: Basics, dry, wet and winter-smooth roadway

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
1. Willumeit, H.-P.: Modelle und Modellierungsverfahren in der Fahrzeugdynamik,
B. G. Teubner Verlag, 1998

2. Mitschke, M./Wallentowitz, H.: Dynamik von Kraftfahrzeugen, Springer-Verlag, Berlin, 2004

3. Gnadler, R.; Unrau, H.-J.: Reprint collection to the lecture Handling Characteristics of Motor Vehicles I

Course: Handling Characteristics of Motor Vehicles II [2114838]

Coordinators: H. Unrau
Part of the modules: Handling Characteristics of Motor Vehicles (p. 94)[WI4INGMB6]

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

Learning Control / Examinations
The assessment will consist of an oral exam (30-40 min) taking place in the recess period and in the lecture period (according to §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.

Recommendations
It is recommended to attend the course *Handling Characteristics of Motor Vehicles I* [2113807] *and Basics of Automotive Engineering I and II* [2113805 and 2114835] beforehand.

Learning Outcomes
The students have an overview of common test methods, with which the handling of vehicles is gauged. They are able to interpret results of different stationary and transient testing methods. Apart from the methods, with which e.g. the driveability in curves or the transient behaviour from vehicles can be registered, also the influences from cross-wind and from uneven roadways on the handling characteristics are well known. They are familiar with the stability behavior from single vehicles and from vehicles with trailer. Consequently they are ready to judge the driving behaviour of vehicles and to change it by specific vehicle modifications.

Content
1. Vehicle handling: Bases, steady state cornering, steering input step, single sine, double track switching, slalom, cross-wind behavior, uneven roadway

2. stability behavior: Basics, stability conditions for single vehicles and for vehicles with trailer

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
1. Zomotor, A.: Fahrwerktechnik: Fahrverhalten, Vogel Verlag, 1991
2. Mitschke, M./Wallentowitz, H.: Dynamik von Kraftfahrzeugen, Springer-Verlag, Berlin, 2004

3. Gnadler, R. Unrau, H.-J.: Reprint collection to the lecture Handling Characteristics of Motor Vehicles II

Course: Vehicle Comfort and Acoustics I [2113806]

Coordinators: F. Gauterin
Part of the modules: Handling Characteristics of Motor Vehicles (p. 94)[WI4INGMB6]

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

Learning Control / Examinations
The assessment consists of an oral exam (30-40 min) taking place in the recess period and in the lecture 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
Can not be combined with lecture [2114856]

Recommendations
None.

Learning Outcomes
The students know what noises and vibrations mean, how they are generated, and how they are perceived by human beings.
They have knowledge about the requirements given by users and the public. They know which components of the vehicle are participating in which way on noise and vibration phenomenon and how they could be improved. They are ready to apply different tools and methods to analyze relations and to judge them. They are able to develop the chasis regarding driving comfort and acoustic under consideration of goal conflicts.

Content
1. Perception of noise and vibrations

3. Fundamentals of acoustics and vibrations

3. Tools and methods for measurement, computing, simulation and analysis of noise and vibrations

4. The relevance of tire and chasis for the acoustic and mechanical driving comfort:
phenomena, influencing parameters, types of construction, optimization of components and systems, conflict of goals, methods of development

An excursion will give insights in the development practice of a car manufacturer or a system supplier.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
1. Michael Möser, Technische Akustik, Springer, Berlin, 2005

2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

3. Manfred Mitschke, Dynamik der Kraftfahrzeuge, Band B: Schwingungen, Springer, Berlin, 1997

The script will be supplied in the lectures

Course: Vehicle Comfort and Acoustics II [2114825]

Coordinators: F. Gauterin
Part of the modules: Handling Characteristics of Motor Vehicles (p. 94)[WI4INGMB6]

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

Learning Control / Examinations
The assessment consists of an oral exam (30-40 minutes) 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
The course can be attended independently from the course *Vehicle Comfort and Acoustics II* [2113806].

Recommendations
None.

Learning Outcomes
The students have knowledge about the noise and vibration properties of the chassis components and the drive train. They know what kind of noise and vibration phenomena do exist, what are the generation mechanisms behind, which components of the vehicle participate in which way and how could they be improved. They have knowledge in the subject area of noise emission of automobiles: Noise impact, legal requirements, sources and influencing parameters, component and system optimization, target conflicts and development methods. They are ready to analyze, to judge and to optimize the vehicle with its single components regarding acoustic and vibration phenomena. They are also able to contribute competently to the development of a vehicle regarding the noise emission.

Content
1. Summary of the fundamentals of acoustics and vibrations

2. The relevance of road surface, wheel imperfections, springs, dampers, brakes, bearings and bushings, suspensions, engines and drive train for the acoustic and mechanical driving comfort:
- phenomena
- influencing parameters
- types of construction
- optimization of components and systems
- conflicts of goals
- methods of development
3. Noise emission of motor vehicles
- noise stress
- sound sources and influencing parameters
- legal restraints
- optimization of components and systems
- conflict of goals
- methods of development

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
The script will be supplied in the lectures.

Course: Vehicle Mechatronics I [2113816]

Coordinators: D. Ammon
Part of the modules: Handling Characteristics of Motor Vehicles (p. 94)[WI4INGMB6], Vehicle Development (p. 95)[WI4INGMB14]

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

Learning Control / Examinations
The assessment will consist of a written exam (90 min) taking place in the recess period (according to §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.

Recommendations
It is recommeded to have knowledge of control engineering, technical mechanics and automobile technology.

Learning Outcomes
The students have an overview of the system science field of mechatronics and its application in the area of vehicle conception, especially in the context of vehicle system dynamics. They know the tools and methods for a systemactical analysis, conception, and design of mechatronic systems, focussing on mechatronically extended suspension systems. They are ready to analyze, to judge and to optimize mechatronic systems.

Content
1. Introduction: Mechatronics in vehicle technology
2. Vehicle Control systems
Brake- and traction controls (ABS, ASR, automated power train controls)
Active and semiactive suspension systems, active stabilizor bars
Vehicle dynamics controls, driver assistence systems
3. Modelling technology
Mechanics - multi body dynamics
Electrical and electronical systems, control systems
Hydraulics
Interdisciplinary coupled systems
4. Computer simulation technology
Numerical integration methods
Quality (validation, operating areas, accuracy, performance)
Simulator-coupling (hardware-in-the-loop, software-in-the-loop)
5. Systemdesign (example: brake control)
Demands, requirements (funktion, safety, robustness)
Problem setup (analysis - modelling - model reduction)
Solution approaches
Evaluation (quality, efficiency, validation area, concept ripeness)

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
1. Ammon, D., Modellbildung und Systementwicklung in der Fahrzeugdynamik, Teubner, Stuttgart, 1997
2. Mitschke, M., Dynamik der Kraftfahrzeuge, Bände A-C, Springer, Berlin, 1984ff
3. Miu, D.K., Mechatronics - Electromechanics and Contromechanics, Springer, New York, 1992
4. Popp, K. u. Schiehlen, W., Fahrzeugdynamik - Eine Einführung in die Dynamik des Systems Fahrzeug-Fahrweg, Teubner, Stuttgart, 1993
5. Roddeck, W., Einführung in die Mechatronik, Teubner, Stuttgart, 1997
6. Zomotor, A., Fahrwerktechnik: Fahrverhalten, Vogel, Würzburg, 1987

Course: Tires and Wheel Development for Passenger Cars [2114845]

Coordinators: G. Leister
Part of the modules: Vehicle Development (p. 95)[WI4INGMB14]

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

Learning Control / Examinations
The assessment will consist of an oral exam (30 - 40 min) taking place in the recess period (according to §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.

Recommendations
Knowledge of automobile technology is recommeded.

Learning Outcomes
The students are informed about the interactions of tires, wheels and chassis. They have an overview of the processes regarding the tire and wheel development. They have knowledge of the physical relationships.

Content
1. The role of the tires and wheels in a vehicle
2. Geometrie of Wheel and tire, Package, load capacity and endurance, Book of requirement
3. Mobility strategy, Minispare, runflat systems and repair kit.
4. Project management: Costs, weight, planning, documentation
5. Tire testing and tire properties
6. Wheel technology incuding Design and manifacturing methods, Wheeltesting
7. Tire presssure: Indirect and direct measuring systems
8. Tire testing subjective and objective

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Manuscript to the lecture

Course: Case studies seminar: Innovation management [2545019]

Coordinators: M. Weissenberger-Eibl
Part of the modules: Entrepreneurship (EnTechnon) (p. 57)[WI4BWLENT1], Innovation Management (p. 58)[WI4BWLENT2]

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

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Recommendations
Prior attendance of the course *Innovation Management* [2545015] is recommended.

Learning Outcomes
The students

- look critically into current research topics in the field of Innovation Managament
- do literature search based on a given topic, identify relevant literature and evaluate this literature,
- give presentations in a scientific context in front of an auditorium to present the results of the research,
- train their presentation skills,
- present results of the research in a seminar thesis as a scientific publication.

Content
The objective of the seminar is to master selected concepts and methods of innovation management and then to apply these practically. Working in groups, the students apply the described concepts and methods of innovation management to a case study from the automotive industry to answer specific questions. Accordingly, the block seminar involves a switch from input to the application of this input. At the end, the results of the group work are presented in the form of a seminar paper and discussed by the whole course.
A short introduction to presentation techniques is planned to help students prepare the seminar papers.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Long-distance and Air Traffic [6232904]

Coordinators: B. Chlond, N.N., Wilko Manz
Part of the modules: Transportation Modelling and Traffic Management (p. 134)[WI4INGBGU16], Fundamentals of Transportation (p. 133)[WI4INGBGU15]

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

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

Conditions
None.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Fabrication Processes in Microsystem Technology [2143882]

Coordinators: K. Bade
Part of the modules: Optoelectronics and Optical Communication (p. 125)[WI4INGMBIMT6], Microfabrication (p. 118)[WI4INGMBIMT2]

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

Learning Control / Examinations
The assessment will consist of a oral exam (20 min) (following §4 (2), 2 of the examination regulation).

Conditions
The course is compulsory in the module Microfabrication and must be examined.

Recommendations
Lectures
Mikrosystemtechnik I [2141861] and/or II [2142874].

Learning Outcomes
The student

- collects advanced knowledge
- understands process conditions and process layout
- gains interdisciplinary knowledge (chemistry, manufacturing, physics)

Content
The lecture offers an advanced understanding of manufacturing processes in microsystem technology. Basic aspects of microtechnological processing will be introduced. With examples from semiconductor microfabrication and microsystem technology the base processing steps for conditioning and finishing, patterning, removal are imparted. Nano-patterning is covered is also included and the micro-nano interface is discussed. By the help of typical processing steps elementary mechanisms, process execution, and equipment are explained. Additionally quality control, process control and environmental topics are included

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
pdf files of presentation sheets

Literature
M. Madou
Fundamentals of Microfabrication
CRC Press, Boca Raton, 1997
W. Menz, J. Mohr, O. Paul
Mikrosystemtechnik für Ingenieure
Dritte Auflage, Wiley-VCH, Weinheim 2005
L.F. Thompson, C.G. Willson, A.J. Bowden
Introduction to Microlithography
2nd Edition, ACS, Washington DC, 1994

Course: Manufacturing Technology [2149657]

Coordinators: V. Schulze, F. Zanger
Part of the modules: Manufacturing Technology (p. 102)[WI4INGMB23]

ECTS Credits	Hours per week	Type	Term	Instruction language
9	4/2	lecture + exercise	Winter term	de

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

Conditions
None

Recommendations
None

Learning Outcomes
The students ...

- are capable to specify the different manufacturing processes and to explain their functions.
- are able to classify the manufacturing processes by their general structure and functionality according to the specific main groups.
- have the ability to perform a process selection based on their specific characteristics.
- are enabled to identify correlations between different processes and to select a process regarding possible applications.
- are qualified to evaluate different processes regarding specific applications based on technical and economic aspects.
- are experienced to classify manufacturing processes in a process chain and to evaluate their specific influence on surface integrity of workpieces regarding the entire process chain.

Content
The objective of the lecture is to look at manufacturing technology within the wider context of production engineering, to provide an overview of the different manufacturing processes and to impart detailed process knowledge of the common processes. The lecture covers the basic principles of manufacturing technology and deals with the manufacturing processes according to their classification into main groups regarding technical and economic aspects. The lecture is completed with topics such as process chains in manufacturing.
The following topics will be covered:

- Quality control
- Primary processing (casting, plastics engineering, sintering, additive manufacturing processes)
- Forming (sheet-metal forming, massive forming, plastics engineering)
- Cutting (machining with geometrically defined and geometrically undefined cutting edges, separating, abrading)
- Joining
- Coating
- Heat treatment and surface treatment
- Process chains in manufacturing

This lucture provides an excursion to an industry company.

Workload
regular attendance: 63 hours
self-study: 207 hours

Media
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).

Literature
Lecture Notes

Remarks
None

Course: Fixed Income Securities [2530260]

Coordinators: M. Uhrig-Homburg
Part of the modules: Finance 2 (p. 27)[WI4BWLFBV2], Finance 3 (p. 28)[WI4BWLFBV11]

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

Learning Control / Examinations
The assessment consists of a written exam following §4, Abs. 2, 1.

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.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature

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

Elective literature:

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

Course: Financial Analysis [2530205]

Coordinators: T. Lüdecke
Part of the modules: Finance 3 (p. 28)[WI4BWLFBV11], Finance 2 (p. 27)[WI4BWLFBV2]

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

Learning Control / Examinations

Conditions
None.

Recommendations
Basic knowledge in corporate finance, accounting, and valuation is required.

Learning Outcomes
Students are able to

- understand the key financial statements according to international standards,
- use financial ratios and financial analysis for different purposes,
- evaluate the financial performance of the firm,
- determine the value of the firm by using residual income and cash flow figures, respectively,
- assess the quality of financial statements.

Content
This lecture reviews the key financial statements according to international financial reporting standards and provides analytical tools to evaluate the income statement, the balance sheet, and the cash flow statement in order to measure a firm's liquidity, operational efficiency, and profitability.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Slides

Literature

- Alexander, D. and C. Nobes (2013): *Financial Accounting – An International Introduction, 5th ed.,* Pearson.
- Penman, S.H. (2013): Financial Statement Analysis and Security Valuation, 5th ed., McGraw Hill.

Remarks
New course starting summer term 2015.

Course: Financial Econometrics [2520022]

Coordinators: M. Schienle
Part of the modules: Econometrics and Statistics II (p. 92)[WI4STAT6], Econometrics and Statistics I (p. 91)[WI4STAT5]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/2	lecture + exercise	Winter term	en

Learning Control / Examinations
The assessment consists of a written exam (90 minutes) (following §4(2), 1 of the examination regulation).

Conditions
None.

Recommendations
Knowledge of the contents covered by the course "Economics III: Introduction in Econometrics" [2520016]

Learning Outcomes
The student

- shows a broad knowledge of fincancial econometric estimation and testing techniques
- is able to apply his/her technical knowledge using software in order to critically assess empirical problems

Content
ARMA, ARIMA, ARFIMA, (non)stationarity, causality, cointegration, ARCH/GARCH, stochastic volatility models, computer based exercises

Workload
The total workload for this course is approximately 135 hours (4.5 credits).
regular attendance: 30 hours
self-study: 65 hours
exam preparation: 40 hours

Media
slides

Literature
References will be provided in the lectures

Remarks
The course is offered in summer term 2016, in winter term 2017/18 and afterwards every second term

Course: Financial Intermediation [2530232]

Coordinators: M. Ruckes
Part of the modules: Finance 3 (p. 28)[WI4BWLFBV11], Finance 2 (p. 27)[WI4BWLFBV2], Economic Theory and its Application in Finance (p. 71)[WI4VWL14], Applied Strategic Decisions (p. 63)[WI4VWL2]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
Students

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

Content

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Elective literature:

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

Course: Fluid Technology [2114093]

Coordinators: M. Geimer, M. Scherer
Part of the modules: Mobile Machines (p. 96)[WI4INGMB15], Automotive Engineering (p. 93)[WI4INGMB5]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2	lecture + exercise	Winter term	de

Learning Control / Examinations
The assessment consists of a writen exam (2 hours) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Learning Outcomes
The students will be able to

- know and understand physical principles of fluid power systems
- know the current components and their operating mode
- know the advantages and disadvantages of different components
- dimension the components for a given purpose
- calculate simple systems

Content
In the range of hydrostatics the following topics will be introduced:

- Hydraulic fluids
- Pumps and motors
- Valves
- Accessories
- Hydraulic circuits.

In the range of pneumatics the following topics will be introduced:

- Compressors
- Motors
- Valves
- Pneumatic circuits.

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Literature
Scritum for the lecture *Fluidtechnik*
Institute of Vehicle System Technology
downloadable

Course: River Engineering and Ecology II [8056]

Coordinators: E. Dister
Part of the modules: Understanding and Prediction of Disasters 1 (p. 148)[WI4INGINTER7], Understanding and Prediction of Disasters 2 (p. 149)[WI4INGINTER8]

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

Learning Control / Examinations
The assessment consists of an oral exam (20 min) taking place in the recess period (according to §4 (2), 2 of the examination regulation).

Conditions
None.

Recommendations
See German version.

Learning Outcomes

Content

Workload
The total workload for this course is approximately 60 hours. For further information see German version.

Remarks
For further information, see http://www.iwk.uni-karlsruhe.de/kurse_vertiefungsstudium.php and http://www.auen.uni-karlsruhe.de/489.php

Course: Advanced Measurement Methods [2501031]

Coordinators: Kottmeier

Part of the modules: Understanding and Prediction of Disasters 1 (p. 148)[WI4INGINTER7], Understanding and Prediction of Disasters 2 (p. 149)[WI4INGINTER8]

ECTS Credits	Hours per week	Type	Term	Instruction language
3,5	2	lecture	Winter term	de

Learning Control / Examinations
The assessment consists of an oral exam (30 min.) taking place in the recess period (according to §4(2), 2 of the examination regulation).

Conditions
None.

Recommendations
None.

Learning Outcomes
see German version

Content
see German version

Workload
The total workload for this course is approximately 105.0 hours. For further information see German version.

Course: Gas Engines [2134141]

Coordinators: R. Golloch
Part of the modules: Combustion Engines II (p. 98)[WI4INGMB35]

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

Learning Control / Examinations
Oral examination, duration 25 min., no auxillary means

Conditions
none

Recommendations
Knowledge about „Verbrennungsmotoren A und B“ or “Fundamentals of Combustion Engines I and II”

Learning Outcomes
The student can name and explain the function, characteristics and application areas of gas and dual fuel engines. He is able to distinguish from engines using liquid fuels. The student describe and explain gaseous fuels, engine subsystems, combustion processes and exhaust gas aftertreatment technologies. He is capable to analyse and evaluate current development areas and technical challenges.

Content
Based on the basics of internal combustion engines the students learn about functions of modern gas and dual fuel engines. Core learning areas are gaseous fuels, combustion processes including abnormal combustion characteristics, subsystems like gas admission, ignition, safety and control systems. Further knowledge will be teached on emissions, exhaust gas aftertreatment, applications and operation characteristics.

Workload
Present time at university: 24 hours; studying at home: 96 hours

Media
Lecture with PowerPoint slides

Literature
Lecture Script, prepared by the lecturer. Obtainable at the Institut für Kolbenmaschinen
Recommended:
- Merker, Schwarz, Teichmann: Grundlagen Verbrennungsmotoren, Vieweg + Teubner Verlag 2011;
- Zacharias: Gasmotoren, Vogel Fachbuch 2001

Course: Field Training Water Quality [6223814]

Coordinators: S. Fuchs, U. Mohrlok
Part of the modules: Environmental Management (p. 132)[WI4INGBGU14]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	practical course	Summer term	de

Learning Control / Examinations
The assessment consists of an oral exam (30 minutes) (following §4(2), 2 of the examination regulation) and an non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
attendance of the course Seminar Water Quality

Recommendations
none

Learning Outcomes
The students can critically evaluate the date obtained in the fiedl by their own with respect to the uncertainty related to the collection of the data as well as the classification into the context of the river basin.

Content

- water sampling methods
- sampling of water qaulity of surface water and groundwater
- structural quality mapping of streams
- determination of oxigen loss in water and sediment
- determination of Ermittlung des saprobic index

Workload
The total workload for this course is approximately 90.0 hours. For further information see German version.

Remarks
The course Seminar Water Quality (6223813) together with the course Field Training Water Quality (6223814) replaces the combination of the courses Surface Water Quality (6223805)/Groundwater Quality (6221811).
The field training takes place at four days by the end of the semester.

Course: Mixed Integer Programming I [2550138]

Coordinators: O. Stein
Part of the modules: Mathematical Programming (p. 86)[WI4OR6]

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

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

Conditions
None.

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

Learning Outcomes
The student

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

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

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

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Lecture notes.

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. 86)[WI4OR6]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise	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* [2550138]. In this case, the duration of the written examination takes 120 minutes.

Conditions
None.

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

Learning Outcomes
The student

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

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

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

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Lecture notes.

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: Global vehicle evaluation within virtual road test [2114850]

Coordinators: B. Schick
Part of the modules: Handling Characteristics of Motor Vehicles (p. 94)[WI4INGMB6]

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

Learning Control / Examinations
The assessment will consist of an oral exam (30-40 min) taking place in the recess period (according to §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.

Recommendations
Previous visit of *Handling Characteristics of Motor Vehicles I* [21807] is recommended.

Learning Outcomes
The students have an overview of the vehicle dynamics simulation, the model parametrization and the related data sources. They have good knowledge about vehicle dynamics test methods and related execution of virtual test driving (open loop, closed loop). They are able to evaluate driving behavior based on self-created results. They have achieved knowledge about influences and interactions of components such as tires, suspension, kinematics and compliance, roll bars, steering, brakes, mass distribution and powertrain and they have the qualification to analyze, to judge and to optimize components with regard to global vehicle behavior.

Content
1. Testing and evaluation methods
2. Fundamentals of vehicle dynamics simulation
3. Execution of virtual test driving and evaluation of the results
4. Influence of several components and optimization of global driving behavior

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
1. Reimpell, J.: Fahrwerktechnik: Grundlagen, Vogel Verlag, 1995
2. Unrau, H.-J.: Scriptum zur Vorlesung “Fahreigenschaften I”
3. Unrau, H.-J.: Scriptum zur Vorlesung “Fahreigenschaften II”
4. IPG: User Guide CarMaker

Course: Business Models in the Internet: Planning and Implementation [2540456]

Coordinators: T. Teubner, R. Knapper
Part of the modules: Entrepreneurship (EnTechnon) (p. 57)[WI4BWLENT1], Business & Service Engineering (p. 42)[WI4BWLISM4]

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

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). 50% of the final grade is based on the written exam and 50% is based on assignments from the exercises. Successful completion of the exercises is a prerequisite for admission to the written exam. 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 student

- is able to list the most important features of web application lifecycles,
- analyses, designs and implements web applications,
- evaluates and argues internet business models with special requirements and features,
- is able to estimate the practicability of business models.

Content
The emergence of internet economy has resulted in an accelerated evolution of commerce models in eBusiness. Early adopters have experimented with a variety of new business models, technologies and application designs. At the same time, there has been a growing demand for new standards to facilitate the exchange of information, catalogue content and transactions between buyers and sellers. But the true understanding of how to bring buyers and sellers together is still widely missing, leading to multiple cases of costly missed investments. This course focuses on the design and implementation of successful business models for eBusiness applications for the World Wide Web (WWW), imparting the basic knowledge for building successful eBusiness applications. We consider not only technical foundations of eBusiness applications but also economical aspects. In small groups, students develop and implement an eBusiness model that is eventually discussed with a representative from the venture capitalist industry.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media

- PowerPoint
- E-Learning-System ILIAS
- Videoconferencing, if circumstances allow

Literature
Will be announced within the course.

Course: Business Planning [2545005]

Coordinators: O. Terzidis, Mitarbeiter des Lehrstuhls
Part of the modules: Entrepreneurship (EnTechnon) (p. 57)[WI4BWLENT1]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
Students will learn methods on how to turn patents as well as business ideas into a solid business model and furthermore to develop them into a concrete Business Plan.

Content
This seminar introduces basic concepts of business planning for entrepreneurs to the participants. It focusses on practical concepts and hands-on-methods on how to turn business ideas into solid businesses (e.g. Business Modelling, Market Potential, Planning of Ressorces, and further more) and on the creation of a realistic and viable Business Plan (with or without Venture Capital)

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
See German version.

Course: Business Strategies of Banks [2530299]

Coordinators: W. Müller
Part of the modules: Finance 3 (p. 28)[WI4BWLFBV11], Finance 2 (p. 27)[WI4BWLFBV2]

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

Learning Control / Examinations

Conditions
None.

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

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

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Elective literature:

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

Course: Foundry Technology [2174575]

Coordinators: C. Wilhelm
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

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

Learning Control / Examinations
The assessment consists of an oral exam (20-30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered upon agreement.

Conditions
None.

Recommendations
None.

Learning Outcomes
The students know the specific moulding and casting techniques and are able to describe them in detail. The students know the application of moulding and casting techniques concerning castings and metals, their advantages and disadvantages in comparision, their application limits and are able to describe these in detail.
The students know the applied metals and are able to describe advantages and disadvantages as well as the specific range of use.
The students are able, to describe detailled mould and core materials, technologies, their application focus and mould-affected casting defects.
The students know the basics of casting process of any casting parts concerning the above mentioned criteria and are able to desvcribe detailled.

Content
Moulding and casting processes
Solidifying of melts
Castability
Fe-Alloys
Non-Fe-Alloys
Moulding and additive materials
Core production
Sand reclamation
Feeding technology
Design in casting technology
Casting simulation
Foundry Processes

Workload
regular attendance: 21 hours
self-study: 99 hours

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

Course: Global Optimization I [2550134]

Coordinators: O. Stein
Part of the modules: Mathematical Programming (p. 86)[WI4OR6]

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

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

Conditions
None.

Learning Outcomes
The student

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

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

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

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Lecture notes.

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: Mathematical Programming (p. 86)[WI4OR6]

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

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

Conditions
None.

Learning Outcomes
The student

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

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

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

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Lecture notes.

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 Production and Logistics - Part 1: Global Production [2149610]

Coordinators: G. Lanza
Part of the modules: Global Production and Logistics (p. 111)[WI4INGMB31]

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

Learning Control / Examinations
Performance is assessed in the form of one written examination (as per §4(2), 1 SPO [study and examination regulations]) during the lecture-free period. The examination will take place once every semester and can be retaken at every official examination date.

Conditions
None

Recommendations
Combination with Global Production and Logistics – Part 2

Learning Outcomes
The students . . .

- can explain the general conditions and influencing factors of global production.
- are capable to apply defined procedures for site selection and to evaluate site decisions with the help of different methods.
- are able to select the adequate scope of design for site-appropriate production and product construction case-specifically.
- can state the central elements in the planning process of establishing a new production site.
- are capable to make use of the methods to design and scale global production networks for company-individual problems.
- are able to show up the challenges and potentials of the departments sales, procurement as well as research and development on global basis.

Content
Target of the lecture is to depict the challenges and fields of action of global operating companies and to give an overview of central aspects in global production networks as well as establishing a deepening knowledge of established methods and procedures for design and scale. Within the course methods for site selection, procedures for site specific adjustment of product construction and product technology as well as planning approaches to establish a new production site are imparted. The course is rounded off by showing the characteristics of the departments sale, procurement as well as research and development under global aspects.
The topics are:

- Basic conditions and influencing factors of global production (historical development, targets, chances and threats)
- Global sales
- Site selection
- Site specific producion adjustment
- Establishing of new production sites
- Global procurement
- Design and management of global production networks
- Global research and development

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).

Literature
Lecture Notes
recommended secondary literature:
Abele, E. et al: Global Production – A Handbook for Strategy and Implementation, Springer 2008 (english)

Remarks
None

Course: Global Production and Logistics - Part 2: Global Logistics [2149600]

Coordinators: K. Furmans
Part of the modules: Global Production and Logistics (p. 111)[WI4INGMB31]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2	lecture	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.

Recommendations
Prerequisites: *Logistics – Organisation, Design and Control of Logistics Systems* [2118078].

Learning Outcomes
Students are able to:

- assign basic problems of planning and operation of global supply chains and plan them with apropriate methods,
- describe requirements and characteristics of global trade and transport, and
- evaluate characteristics of the design from logistic chains regarding their suitability.

Content
Characteristics of global trade

- Incoterms
- Customs clearance, documents and export control

Global transport and shipping

- Maritime transport, esp. container handling
- Air transport

Modeling of supply chains

- SCOR model
- Value stream analysis

Location planning in cross-border-networks

- Application of the Warehouse Location Problem
- Transport Planning

Inventory Management in global supply chains

- Stock keeping policies

Inventory management considering lead time and shipping costs

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
presentations, black board

Literature
Elective literature:

- Arnold/Isermann/Kuhn/Tempelmeier. HandbuchLogistik, Springer Verlag, 2002 (Neuauflage in Arbeit)
- Domschke. Logistik, Rundreisen und Touren,Oldenbourg Verlag, 1982
- Domschke/Drexl. Logistik, Standorte, OldenbourgVerlag, 1996
- Gudehus. Logistik, Springer Verlag, 2007
- Neumann-Morlock. Operations-Research,Hanser-Verlag, 1993
- Tempelmeier. Bestandsmanagement in SupplyChains, Books on Demand 2006
- Schönsleben. IntegralesLogistikmanagement, Springer, 1998

Course: Graph Theory and Advanced Location Models [2550484]

Coordinators: S. Nickel
Part of the modules: Mathematical Programming (p. 86)[WI4OR6], Operations Research in Supply Chain Management and Health Care Management (p. 84)[WI4OR5]

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

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

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

Learning Outcomes
The student

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

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature

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

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

Course: Fundamentals of Waste Water Treatment [22618]

Coordinators: H. Horn
Part of the modules: Water Chemistry and Water Technology II (p. 147)[WI4INGCV7]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2/0	lecture	Summer term	de

Learning Control / Examinations
See module description.

Conditions
None.

Learning Outcomes
The student

- has knowledge about the basic understanding of wastewater treatment plants,
- knows about the main design criteria, including procedural plant configurations and operating factors and processes.

Content
Historical background, types of wastewater and wastewater composition, wastewater definition and legal aspects, wastewater analytics and characterization, mechanical wastewater treatment (descition and design of grids, sieves, and sedimentation tanks), introduction of biological principles, biological wastewater treatment (the activated sludge process, concepts, design of C,N and P elimination processes, aeration units), biofilm technology (introduction to biofilms, process description and design of trickling filters, moving bed biofilm systems, and so on), special treatment processes (membrane systems, and other), anaerobic processes (treatmemt and disposal of sewage sludge), industrial applications.

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Literature
Elective literature:

- Wastewater Engineering. Treatment and Reuse, Taschenbuch, 1830 Seiten, Mcgraw-Hill Higher Education; 4. Aufl. (2002); ISBN-10: 0071122508

Course: Automotive Engineering I [2113805]

Coordinators: F. Gauterin, H. Unrau
Part of the modules: Automotive Engineering (p. 93)[WI4INGMB5]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	4	lecture	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam (120 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
Can not be combined with lecture [2113809]

Recommendations
None.

Learning Outcomes
The students know the movements and the forces at the vehicle and are familiar with active and passive security. They have proper knowledge about operation of engines and alternative drives, the necessary transmission between engine and drive wheels and the power distribution. They have an overview of the components necessary for the drive and have the basic knowledge, to analyze, to judge and to develop the complex system "vehicle".

Content
1. History and future of the automobile
2. Driving mechanics: driving resistances and driving performances, mechanics of the longitudinal and transverse forces, collision mechanics

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

4. Transmission: clutches (e.g. friction clutch, visco clutch), transmission (e.g. mechanical transmission, hydraulic fluid transmission)

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

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

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

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

Course: Automotive Engineering II [2114835]

Coordinators: F. Gauterin, H. Unrau
Part of the modules: Automotive Engineering (p. 93)[WI4INGMB5]

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

Learning Control / Examinations
The assessment consists of a written exam (90 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
Can not be combined with lecture [2114855]

Recommendations
It is recommeded to attend the course *Basics of Automotive Engineering I* [2113805].

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

Content
1. Chassis: Wheel suspensions (rear axles, front axles, kinematics of axles), tyres, springs, damping devices
2. Steering elements: Manual steering, servo steering, steer by wire
3. Brakes: Disc brake, drum brake, retarder, comparison of the designs

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

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

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

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

Course: River Engineering and Ecology I [8048]

Coordinators: E. Dister
Part of the modules: Understanding and Prediction of Disasters 1 (p. 148)[WI4INGINTER7], Understanding and Prediction of Disasters 2 (p. 149)[WI4INGINTER8]

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

Learning Control / Examinations
The assessment consists of an oral exam (20 min) taking place in the recess period (according to §4 (2), 2 of the examination regulation).

Conditions
None.

Learning Outcomes

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Remarks
For further information, see http://www.iwk.uni-karlsruhe.de/kurse_vertiefungsstudium.php and http://www.ifgg.kit.edu/1828.php

Course: Basic principles of powder metallurgical and ceramic processing [2193010]

Coordinators: R. Oberacker
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

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

Learning Control / Examinations
The assessment consists of an oral exam (20-30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered upon agreement.

Conditions
None.

Recommendations
Basic knowledge of experimental physics and chemistry is recommended.

Learning Outcomes
The students know the basics of characterization of powders, pastes and suspensions. They have a fundamental understanding of the process technology for shaping of particulate systems. They are able to use these fundamentals to design selected wet- and dry forming processes.

Content
The course covers fundamentals of the process technology for shaping of ceramic or metal particle systems. Important shaping methods are reviewed. The focus is on characterization and properties of particulate systems, and, in particular, on process technology for shaping of powders, pastes, and suspensions.

Workload
regular attendance: 25 hours
self-study: 95 hours

Media
Slides for the lecture:
available under http://ilias.studium.kit.edu

Literature

- R.J. Brook: Processing of Ceramics I+II, VCH Weinheim, 1996
- M.N. Rahaman: Cermamic Processing and Sintering, 2nd Ed., Marcel Dekker, 2003
- W. Schatt ; K.-P. Wieters ; B. Kieback. „Pulvermetallurgie: Technologien und Werkstoffe“, Springer, 2007
- R.M. German. “Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005
- F. Thümmler, R. Oberacker. “Introduction to Powder Metallurgy”, Institute of Materials, 1993

Course: Basics in Hydrogeology [9050]

Coordinators: N. Goldscheider
Part of the modules: Understanding and Prediction of Disasters 1 (p. 148)[WI4INGINTER7], Understanding and Prediction of Disasters 2 (p. 149)[WI4INGINTER8]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/2	lecture + exercise	Winter term	de

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

Conditions
None.

Recommendations
None.

Learning Outcomes
see German version

Content
see German version

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Remarks
This course was formerly named “Hydrogeology”.

Course: Fundamentals of catalytic exhaust gas aftertreatment [2134138]

Coordinators: E. Lox
Part of the modules: Combustion Engines II (p. 98)[WI4INGMB35]

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

Learning Control / Examinations
The assessment consists of an oral exam (30 min) according to §4 (2), 2 of the examination regulation. The grade of the exam is included in the overall grade of the module with a weighting factor of 3.

Conditions
The course *Combustion Engines A / Combustion Engines I* has to be completed beforehand.

Recommendations
None.

Learning Outcomes
The students can name and explain the scientific fundamentals of the catalytic exhaust gas aftertreatment, as well as the technical, political and economical parameters of its application in engines for passenger cars and HD vehicles.

The students are able to point out and explain which emissions are formed in combustion engines, why these emissions are helth-related critical and which measures the legislator has established to reduce the emissions.

Content
1. kind and source of emissions
2. emission legislation
3. principal of catalytic exhaust gas aftertreatment (EGA)
4. EGA at stoichiometric gasoline engines
5. EGA at gasoline engines with lean mixtures
6. EGA at diesel engines
7. economical basic conditions for catalytic EGA

Workload
regular attendance: 36 hours
self-study: 84 hours

Literature
Lecture notes available in the lectures

1. "Environmental Catalysis" Edited by G.Ertl, H. Knötzinger, J. Weitkamp Wiley-VCH Verlag GmbH, Weinheim, 1999 ISBN 3-527-29827-4
2. "Cleaner Cars- the history and technology of emission control since the 1960s" J. R. Mondt Society of Automotive Engineers, Inc., USA, 2000 Publication R-226, ISBN 0-7680-0222-2
3. "Catalytic Air Pollution Control - commercial technology" R. M. Heck, R. J. Farrauto John Wiley & Sons, Inc., USA, 1995 ISBN 0-471-28614-1
4. "Automobiles and Pollution" P. Degobert Editions Technic, Paris, 1995 ISBN 2-7108-0676-2
5. "Reduced Emissions and Fuel Consumption in Automobile Engines" F. Schaeder, R. van Basshuysen, Springer Verlag Wien New York, 1995 ISBN 3-211-82718-8
6. "Autoabgaskatalysatoren : Grudlagen - Herstellung - Entwicklung - Recycling - Ökologie" Ch. Hagelüken und 11 Mitautoren, Expert Verlag, Renningen, 2001 ISBN 3-8169-1932-4

Course: Fundamentals of Food Chemistry [6602]

Coordinators: Loske
Part of the modules: Specialization in Food Process Engineering (p. 145)[WI4INGCV4]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2	lecture	Winter / Summer Term	de

Learning Control / Examinations
See module description.

Conditions
None.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Course: Principles of Food Process Engineering [22213]

Coordinators: V. Gaukel
Part of the modules: Principles of Food Process Engineering (p. 144)[WI4INGCV3]

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

Learning Control / Examinations
See module description.

Conditions
The course is an obligatory course within the module and has to be attended.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Remarks
This course was formerly named “Principles of Process Engineering referring to Food I”.

Course: Introduction to Microsystem Technology I [2141861]

Coordinators: A. Guber, Prof. J. Korvink
Part of the modules: Microsystem Technology (p. 122)[WI4INGMBIMT4]

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

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

Conditions
None.

Recommendations
The course Microsystem technology II [2142874] and the practical exercise [2143875] are recommended.

Learning Outcomes
The lecture gives an introduction into the basics of microsystems technology. In analogy to processes employed in fabrication of microelectronics circuits the core technologies as well as materials for producing microstructures and components are presented. Finally, various techniques for Silicon micromachining are explained and illustrated with examples for micro-components and micro-systems.

Content
- Introduction in Nano- and Microtechnologies
- Silicon and processes for fabricating microelectronics circuits
- Basic physics background and crystal structure
- Materials for micromachining
- Processing technologies for microfabrication
- Silicon micromachining
- Examples

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
M. Madou
Fundamentals of Microfabrication
Taylor & Francis Ltd.; Auflage: 3. Auflage. 2011

Course: Introduction to Microsystem Technology II [2142874]

Coordinators: A. Guber, Prof. Dr. J. Korvink
Part of the modules: Microsystem Technology (p. 122)[WI4INGMBIMT4]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	en

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

Conditions
None.

Recommendations
The course Microsystem technology I [2141861] and the practical exercise [2143875] are recommended.

Learning Outcomes
The lecture gives an introduction into the basics of microsystems technology. In the first part, methods for lithographic pattern transfer are summarized. Then specific techniques such as the LIGA process, micro-machining, and laser-patterning are explained and examples are given. Finally assembly and packaging methods are presented leading into a discussion of entire microsystems.

Content
- Introduction in Nano- and Microtechnologies
- Lithography
- LIGA-technique
- Mechanical microfabrication
- Patterning with lasers
- Assembly and packaging
- Microsystems

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
M. Madou
Fundamentals of Microfabrication
Taylor & Francis Ltd.; Auflage: 3. Auflage. 2011

Course: Fundamentals of X-ray Optics I [2141007]

Coordinators: A. Last
Part of the modules: Microfabrication (p. 118)[WI4INGMBIMT2], Microoptics (p. 120)[WI4INGMBIMT3]

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

Learning Control / Examinations
The assessment will consist of a oral exam (30 min) (following §4 (2), 2 of the examination regulation).

Conditions
None.

Recommendations
Attending the following Lectures is recommended:
LAS:
Beschleunigerphysik I: Teilchenbeschleuniger
Beschleunigerphysik II: Synchrotronstrahlungsquellen
IMT:
Grundlagen der Mikrosystemtechnik I [2141861] and II [2142874]

Learning Outcomes
The lecture will enable the students to judge capabilities of different X-ray optical imaging methods and instrumentation and to select suitable methods for a given task.

Content
The lecture covers general principles of optics as well as basics, functioning and application of reflective, refractive and diffractive X-ray optical elements and systems. Selected X-ray analytical imaging methods and the necessary optical elements are discussed including their potentials and limitations.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
M. Born und E. Wolf
Principles of Optics, 7th (expanded) edition
Cambridge University Press, 2010
A. Erko, M. Idir, T. Krist und A. G. Michette
Modern Developments in X-Ray and Neutron Optics
Springer Series in Optical Sciences, Vol. 137
Springer-Verlag Berlin Heidelberg, 2008
D. Attwood
Soft X-Rays and Extreme Ultraviolet Radiation: Principles and Applications
Cambridge University Press, 1999

Remarks
Lecture dates will be fixed in agreement with the students, see institutes website.
A visit at synchrotron ANKA is possible if requested.

Course: Fundamentals of X-ray optics II [2142007]

Coordinators: A. Last
Part of the modules: Microoptics (p. 120)[WI4INGMBIMT3]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
The assessment will consist of a oral exam (30 min) (following §4 (2), 2 of the examination regulation).

Conditions
Fundamentals of X-ray optics I [2142007] must be examined beforehand.

Recommendations
Attending the following Lectures is recommended:
LAS:
Beschleunigerphysik I: Teilchenbeschleuniger
Beschleunigerphysik II: Synchrotronstrahlungsquellen
IMT:
Grundlagen der Mikrosystemtechnik I [2141861] und II [2142874]

Learning Outcomes
Attending this lecture enables the intrigued student to identify applications for X-ray optical methods of analysis and to choose the most suitable method.
The student

- knows various X-ray imaging systems and their setups, purposes and functional limits
- Understands the basic functionality of X-ray imaging detectors
- knows methods of processing and analysis of data accruing from X-ray imaging systems
- has the knowledge to decide which X-ray imaging system matches a given analysis problem and how to use the chosen system

Content
During the lecture properties of X-ray optical elements and systems are discussed. X-ray imaging mehtods of analysis are derived and preconditions to employ such methods are elaborated in dependence of the expected results and with respect to boundary conditions given by the sampe system.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Slides of the lecture

Literature

- M. Born und E. Wolf: Principles of Optics, 7th (expanded) edition, Cambridge University Press, 2010
- A. Erko, M. Idir, T. Krist und A. G. Michette: Modern Developments in X-Ray and Neutron Optics, Springer Series in Optical Sciences, Vol. 137, Springer-Verlag Berlin Heidelberg, 2008
- D. Attwood: Soft X-Rays and Extreme Ultraviolet Radiation: Principles and Applications, Cambridge University Press, 1999

Course: Basics of Technical Logistics [2117095]

Coordinators: M. Mittwollen, Madzharov
Part of the modules: Technical Logistics (p. 106)[WI4INGMB27], Introduction to Logistics (p. 99)[WI4INGMB20]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	3/1		Winter term	de

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

Conditions
None.

Recommendations
Some technical knowledge.

Learning Outcomes
Students are able to:

- Describe processes and machines of technical logistics,
- Model the fundamental structures and the impacts of material handling machines with mathematical models,
- Refer to industrially used machines and
- Model real machines applying knowledge from lessons and calculate their dimensions.

Content
Bases effect model of conveyor machines made for the change of position and orientation; conveyor processes; identification systems; drives; mechanical behaviour of conveyors; structure and function of conveyor machines; elements of intralogistics sample applications and calculations in addition to the lectures inside practical lectures

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

Media
supplementary sheets,projector, blackboard

Literature
Recommendations during lessons

Course: Fundamentals for Design of Motor-Vehicles Bodies I [2113814]

Coordinators: H. Bardehle
Part of the modules: Automotive Engineering (p. 93)[WI4INGMB5]

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

Learning Control / Examinations
The assessment consists of an oral exam (30 min) taking place in the recess period (according to §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.

Recommendations
None.

Learning Outcomes
The students have an overview of the fundamental possibilities for design and manufacture of motor-vehicle bodies. They know the complete process, from the first idea, through the concept to the dimensioned drawings (e.g. with FE-methods). They have knowledge about the fundamentals and their correlations, to be able to analyze and to judge relating components as well as to develop them accordingly.

Content
1. History and design

2. Aerodynamics

3. Design methods (CAD/CAM, FEM)

4. Manufacturing methods of body parts

5. Fastening technologie

6. Body in white / body production, body surface

Workload
The total workload for this course is approximately 45 hours. For further information see German version.

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

Course: Fundamentals for Design of Motor-Vehicles Bodies II [2114840]

Coordinators: H. Bardehle
Part of the modules: Automotive Engineering (p. 93)[WI4INGMB5]

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

Learning Control / Examinations
The assessment consists of an oral exam (30 min) taking place in the recess period (according to §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.

Recommendations
It is recommended to attend the course *Fundamentals for Design of Motor-Vehicle Bodies I* [21814] beforehand.

Learning Outcomes
The students know that, often the design of seemingly simple detail components can result in the solution of complex problems. They have knowledge in testing procedures of body properties. They have an overview of body parts such as bumpers, window lift mechanism and seats. They understand, as well as, parallel to the normal electrical system, about the electronic side of a motor vehicle. Based on this they are ready to analyze and to judge the relation of these single components. They are also able to contribute competently to complex development tasks by imparted knowledge in project management.

Content
1. Body properties/testing procedures

2. External body-parts

3. Interior trim

4. Compartment air conditioning

5. Electric and electronic features

6. Crash tests

7. Project management aspects, future prospects

Workload
The total workload for this course is approximately 45 hours. For further information see German version.

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

Course: Fundamentals in the Development of Commercial Vehicles I [2113812]

Coordinators: J. Zürn
Part of the modules: Mobile Machines (p. 96)[WI4INGMB15], Vehicle Development (p. 95)[WI4INGMB14]

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

Learning Control / Examinations
Assessment for the module *Mobile Machines*: See module description.
Assessment for the module *Automotive Engineering*: The assessment consists of an oral exam (20 min) taking place in 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.

Recommendations
None.

Learning Outcomes
The students have proper knowledge about the process of commercial vehicle development starting from the concept and the underlying original idea to the real design. They know that the customer requirements, the technical realisability, the functionality and the economy are important drivers.
The students are able to develop parts and components. Furthermore they have knowledge about different cab concepts, the interior and the interior design process. Consequently they are ready to analyze and to judge concepts of commercial vehicles as well as to participate competently in the commercial vehicle development.

Content
1. Introduction, definitions, history
2. Development tools
3. Complete vehicle
4. Cab, bodyshell work
5. Cab, interior fitting
6. Alternative drive systems
7. Drive train
8. Drive system diesel engine
9. Intercooled diesel engines

Workload
The total workload for this course is approximately 45 hours. For further information see German version.

Literature
1. Marwitz, H., Zittel, S.: ACTROS – die neue schwere Lastwagenbaureihe von Mercedes-Benz, ATZ 98, 1996, Nr. 9

2. Alber, P., McKellip, S.: ACTROS – Optimierte passive Sicherheit, ATZ 98, 1996

3. Morschheuser, K.: Airbag im Rahmenfahrzeug, ATZ 97, 1995, S. 450 ff.

Course: Fundamentals in the Development of Commercial Vehicles II [2114844]

Coordinators: J. Zürn
Part of the modules: Mobile Machines (p. 96)[WI4INGMB15], Vehicle Development (p. 95)[WI4INGMB14]

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

Learning Control / Examinations
Assessment for the module *Mobile Machines*: See module description.
Assessment for the module *Automotive Engineering*: The assessment will consist of an oral exam (20 min) taking place in the recess period (according to §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.

Recommendations
It is recommended to attend the course *Fundamentals in the Development of Passenger Vehicles I* [21810] beforehand.

Learning Outcomes
The students know the advantages and disadvantages of different drives. Furthermore they are familiar with components, such as transfer box, propeller shaft, powered and non-powered frontaxle etc. Beside other mechanical components, such as chassis, axle suspension and braking system, also electric and electronic systems are known. Consequently the student are able to analyze and to judge the general concepts as well as to adjust them precisely with the area of application.

Content
1. Gear boxes of commercial vehicles
2. Intermediate elements of the drive train
3. Axle systems
4. Front axles and driving dynamics
5. Chassis and axle suspension
6. Braking System
7. Systems
8. Excursion

Workload
The total workload for this course is approximately 45 hours. For further information see German version.

Literature
1. Schittler, M., Heinrich, R., Kerschbaum, W.: Mercedes-Benz Baureihe 500 – neue V-Motorengeneration für schwere Nutzfahrzeuge, MTZ 57 Nr. 9, S. 460 ff., 1996

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

3. Rubi, V., Strifler, P. (Hrsg. Institut für Kraftfahrwesen RWTH Aachen): Industrielle Nutzfahrzeugentwicklung, Schriftenreihe Automobiltechnik, 1993

Course: Fundamentals of Automobile Development I [2113810]

Coordinators: R. Frech
Part of the modules: Vehicle Development (p. 95)[WI4INGMB14]

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

Learning Control / Examinations
The assessment consists of a written exam (90 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.

Recommendations
None.

Learning Outcomes
The students have an overview of the fundamentals of the development of automobiles. They know the development process, the national and the international legal requirements that are to be met. They have knowledge about the thermo-management, aerodynamics and the design of an automobile. They are ready to judge goal conflicts in the field of automobile development and to work out approaches to solving a problem.

Content
1. Process of automobile development
2. Conceptual dimensioning and design of an automobile
3. Laws and regulations – National and international boundary conditions
4. Aero dynamical dimensioning and design of an automobile I
5. Aero dynamical dimensioning and design of an automobile II
6. Thermo-management in the conflict of objectives between styling, aerodynamic and packaging guidelines I
7. Thermo-management in the conflict of objectives between styling, aerodynamic and packaging guidelines II

Workload
The total workload for this course is approximately 45 hours. For further information see German version.

Literature
The scriptum will be provided during the first lessons

Course: Fundamentals of Automobile Development II [2114842]

Coordinators: R. Frech
Part of the modules: Vehicle Development (p. 95)[WI4INGMB14]

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

Learning Control / Examinations
The assessment consists of a written exam (90 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.

Recommendations
It is recommended to attend the course *Fundamentals in the Development of Passenger Vehicles I* [21810] beforehand.

Learning Outcomes
The students are familiar with the selection of appropriate materials and the choice of adequate production technology. They have knowledge of the acoustical properties of the automobiles, covering both the interior sound and exterior noise. They have an overview of the testing procedures of the automobiles. They know in detail the evaluation of the properties of the complete automobile. They are ready to participate competently in the development process of the complete vehicle.

Content
1. Application-oriented material and production technology I
2. Application-oriented material and production technology II
3. Overall vehicle acoustics in the automobile development
4. Drive train acoustics in the automobile development
5. Testing of the complete vehicle
6. Properties of the complete automobile

Workload
The total workload for this course is approximately 45 hours. For further information see German version.

Literature
The scriptum will be provided during the first lessons.

Course: Principles of Information Engineering and Management [2540450]

Coordinators: C. Weinhardt, T. Teubner
Part of the modules: Information Engineering (p. 44)[WI4BWLISM7]

ECTS Credits	Hours per week	Type	Term	Instruction language
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).

Conditions
None.

Learning Outcomes
The students should be able to understand and analyze the central role of information as an economic good, a production factor, and a competitive factor in today's societies. Students are supposed to be able to identify, evaluate, price, and market information goods with the help of the concepts and methods taught in the lecture. Furthermore, students learn basic aspects about information systems and information flows within and between organizations, as well as their design parameters.

Content
Information plays a central role in today's society. The resulting structures and processes cannot be explained intuitively with traditional approaches of economic theory. Formerly, information has only been implicitly treated as a production factor; its role as a competitive factor used to be neglected. In order to deal with the central role of information we developed the concept of the "information lifecycle" that systematizes all phases from information generation to information distribution. The single phases of that cycle,

- extraction/generation,
- storage,
- transformation,
- evaluation,
- marketing
- and usage of information

are analyzed from the business administration perspective and the microeconomic perspective. The state of the art of economic theory is presented across this information lifecycle within the lectures. The content of the lecture is deepened in accompanying lecture courses.

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Media

- PowerPoint
- E-learning platform ILIAS

Literature

- Shapiro, C., Varian, H., Information Rules: A Strategic Guide to the Network Economy. Harvard Business School Press 1999.
- Stahlknecht, P., Hasenkamp, U., Einführung in die Wirtschaftsinformatik. Springer Verlag 7. Auflage, 1999.
- Wirth, H., Electronic Business. Gabler Verlag 2001.

Course: Freight Transport [6232809]

Coordinators: B. Chlond
Part of the modules: Transportation Modelling and Traffic Management (p. 134)[WI4INGBGU16], Fundamentals of Transportation (p. 133)[WI4INGBGU15], Public Transportation Operations (p. 137)[WI4INGBGU26]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	1/1	lecture + exercise	Summer term	de

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

Conditions
See module description.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Quantum Functional Devices and Semiconductor Technology [23476]

Coordinators: M. Walther
Part of the modules: Nanotechnology (p. 124)[WI4INGMBIMT5], Optoelectronics and Optical Communication (p. 125)[WI4INGMBIMT6]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
The assessment will consist of a oral exam (20 min) (following §4 (2), 2 of the examination regulation).

Conditions
None.

Learning Outcomes
Students

- will be proficient in the basics of optical and electrical devices with carrier confinement
- will understand carrier confinement effects in low-dimensional systems for optical and electrical devices
- acquire knowledge in the technology for realization of modern semiconductor devices
- will deal with future trends and scaling limits in micro- and opto-electronics.

Content
Fundamental properties of quantum functional devices
Heterostructures and band gap engineering
Carrier confinement in 2-, 1- and 0-dim structures
Quantum functional compound semiconductor devices
High electron mobility transistors
Quantum well, quantum dot and quantum cascade lasers
Infrared detectors
Compound semiconductor technology
Epitaxy, lithography, etching and deposition
Future trends in microelectronics
Scaling limits, Moore‘s law, devices beyond Moore

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
script

Course: Commercial and Corporate Law [24011]

Coordinators: Z. (ZAR), O. Knöfel
Part of the modules: Commercial Law (p. 151)[WI4JURA2]

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

Learning Control / Examinations
The assesment ist explained in the module description

Conditions
None.

Recommendations
It is recommended to attend the lecture *BGB for Advanced* [24504] in advance.

Learning Outcomes
the student is able to overview the specifics of commercial transactions, commercial agency and the law of merchants. Moreover, he knows the forms of organization available in German company law.

Content
The lecture begins with an introduction into the different terms of merchants of the German Commercial Code. Subsequently, the rules governing trade names, commercial registries and commercial agency are dealt with. This is followed by a presentation of the general rules of commercial transactions and of the specific commercial transactions. In company law, first of all, the basics of partnerships are explained. Thereafter, the focus will be on corporate law which is most important in practice.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Slides.

Literature
Klunzinger, Eugen

- Grundzüge des Handelsrechts, Verlag Vahlen, latest edition
- Grundzüge des Gesellschaftsrechts, Verlag Vahlen, latest edition

Elective literature:
tba at the beginning of the course.

Course: Homework “Public Transportation Operations” [n.n.]

Coordinators: E. Hohnecker, assistants
Part of the modules: Public Transportation Operations (p. 137)[WI4INGBGU26]

ECTS Credits	Hours per week	Type	Term	Instruction language
3		other		

Learning Control / Examinations
written elaboration

Conditions
None.

Learning Outcomes

Content

Workload

Course: Homework “Track Guided Transport Systems / Engineering” [n.n.]

Coordinators: E. Hohnecker, assistants
Part of the modules: Track Guided Transport Systems / Engineering (p. 138)[WI4INGBGU27]

ECTS Credits	Hours per week	Type	Term	Instruction language
3		other		

Learning Control / Examinations
written elaboration

Conditions
None.

Learning Outcomes

Content

Workload

Course: Homework “Project in Public Transportation” [n.n.]

Coordinators: E. Hohnecker, assistants
Part of the modules: Project in Public Transportation (p. 136)[WI4INGBGU25]

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

Learning Control / Examinations
written elaboration

Conditions
None.

Learning Outcomes

Content

Workload

Course: High-Voltage Test Technique [23392/23394]

Coordinators: R. Badent
Part of the modules: Generation and transmission of renewable power (p. 143)[WI4INGETIT7]

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

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

Conditions
None.

Recommendations
High-Voltage-Technology I and II

Learning Outcomes
The student can measure partial discharges, can conduct On-site testings and is able to check cables and accessories. Furthermore he can use and design computer aided test systems and create the necessary conditions for the accreditation of test
laboratories.

Content

- High voltage test technique
- PD-measurement
- Transformer testing
- Cable and garniture
- Switchyard
- Insulators and overhead pipeline fittings
- Computer based test systems in the area of high voltage testing
- Accreditation of test laboratories

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Elective literature:
Küchler, A.; Hochspannungstechnik, Springer Verlag 2005

Course: High-Voltage Technology I [23360/23362]

Coordinators: R. Badent
Part of the modules: High-Voltage Technology (p. 142)[WI4INGETIT6]

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

Learning Control / Examinations
See German version.

Conditions
Basic Network and Field Theory

Learning Outcomes
The students know how to calculate electric fields with the help of numeric or graphical methods.

Content

- Electric potential fields
- Maxwell's equations
- Calculation of static electric fields, charge simulation method
- Difference method, Finite-Element method, Monte-Carlo method, Boundary-element method
- Graphical field evaluation
- Measurement of electric fields, field energy and field forces
- Polarization, boundary layers, inclusions, DC and AC voltage distribution in imperfect dielectrics
- Frequency and temperature dependency of the dissipation factor
- Generation of high DC/AC and impulse voltages and high impulse currents for testing

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Küchler, Andreas; Hochspannungstechnik, Springer Verlag 2. Auflage 2005, ISBN 3-540-21411-9

Course: High-Voltage Technology II [23361/23363]

Coordinators: R. Badent
Part of the modules: High-Voltage Technology (p. 142)[WI4INGETIT6]

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

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

Conditions
None.

Learning Outcomes
The students can dimension, design and calculate high-voltage generators for the generation of high direct current, AC voltage and pulse voltage.

Content
Gas discharges, gaseous electronics, atomic energy niveaus, self-sustained and nonselfsustained discharges
Townsend mechanisms, channel mechanism, similarity laws, Paschen's law
Glow discharges, sparks, arcs, partial discharges, breakdown of liquid and solid dielectrics Statistics of electrical breakdown
Insulation coordination, roots of overvoltage's, trans-mission line equations, travelling wave theory

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Elective literature:
Küchler, A. Hochspannungstechnik; Springer Verlag, 2005

Course: Real Estate Economics and Sustainability Part 1: Basics and Valuation [2586407]

Coordinators: D. Lorenz
Part of the modules: Real Estate Economics and Sustainability (p. 61)[WI4BWLÖÖW1]

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

Learning Control / Examinations
The examination for the courses generally consist of a 60 minute written exam. A 20 minute oral exam is only offered after the second failure of the written exam. The exams for the respective parts (Part 1: Basics and Valuation and Part 2: Reporting and Rating) happen in the same semester in which the lectures take place.
Therefore, Part I currently only takes place in the winter semester and Part II takes place in the summer semester. In each semester there are two alternative dates for the exam and exams can be re-sat at any regular exam date.

Conditions
None.

Recommendations
A combination with courses in the area of

- Finance
- Insurance
- Civil engineering and architecture

is recommended.
Particularly recommended is the successful completion of the following Bachelor-Modules:

- Real Estate Management I and II
- Design, Construction and Assessment of Green Buildings I and II

Learning Outcomes
The student

- possesses an overview of key interrelationships within the real estate industry concerning macro- and microeconomic questions as well as the interaction of the industry's key players;
- is aware of the basics concerning the sustainable development debate and knows about the possible contribution of buildings and the real estate industry to a more sustainable development;
- knows the basics, key methods and tools of property valuation and is able to apply them;
- is aware of the key influencing factors of a building's market value and is able to factor in sustainability considerations into market value estimates;

Content
This course is concerned with the implementation of sustainable development principles within the real estate industry. The focus lies on the role of property valuation and of property professionals.
The basics, key methods and tools of property valuation are explained in detail and are discussed within the context of the sustainable development debate.
The tutorial provides examples in order to practice the application of theoretical knowledge to practical problems; i.e. valuation assignments.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Presentation slides and supplementary material is provided partly as printout, partly online for download.

Course: Real Estate Economics and Sustainability Part 2: Reporting and Rating [2585406]

Coordinators: D. Lorenz
Part of the modules: Real Estate Economics and Sustainability (p. 61)[WI4BWLÖÖW1]

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

Learning Control / Examinations
The examination for the courses generally consist of a 60 minute written exam. A 20 minute oral exam is only offered after the second failure of the written exam. The exams for the respective parts (Part 1: Basics and Valuation and Part 2: Reporting and Rating) happen in the same semester in which the lectures take place.
Therefore, Part I currently only takes place in the winter semester and Part II takes place in the summer semester. In each semester there are two alternative dates for the exam and exams can be re-sat at any regular exam date.

Conditions
None.

Recommendations
A combination with courses in the area of

- Finance
- Insurance
- Civil engineering and architecture

is recommended.
Particularly recommended is the successful completion of the following Bachelor-Modules:

- Real Estate Management I and II
- Design, Construction and Assessment of Green Buildings I and II

Learning Outcomes
The student

- possesses an overview of important methods and processes which are applied within the real estate industry to assess property related risks (e.g. property ratings);
- is aware of key instruments to communicate property performance towards third parties (e.g. sustainability assessment of buildings and sustainability reporting of companies).

Content
This course is concerned with the implementation of sustainable development principles within the real estate industry.
The course explains important methods and procedures – besides property valuation – which are applied within the industry in order to assess property related risks (e.g. property rating) and discusses them within the context of the sustainable development debate. Further topics in this regard are:

- sustainability assessment of buildings,
- sustainability reporting of companies,
- sustainable property investment products,
- assessment of real estate funds and investment vehicles, and
- sustainability and real estate lending.

The tutorial provides examples in order to practice the application of theoretical knowledge to practical real estate related problems.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Presentation slides and supplementary material is provided partly as printout, partly online for download.

Course: Industrial Services [2595505]

Coordinators: H. Fromm
Part of the modules: Service Management (p. 43)[WI4BWLISM6], Service Analytics (p. 59)[WI4BWLKSR1]

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

Learning Control / Examinations
A final written exam will be conducted

Conditions
None.

Learning Outcomes
Participants understand the interrelation between Front-Office (Customer view, e.g. material availability, technician skills, maintenance quality, repair time) and Back-Office (Provider view, e.g. distribution planning, inventory optimization, technician work schedule, call center). They learn about forecasting algorithms for sporadic demands, which are typical in spare part supply, and they apply common inventory optimization models for stock planning. They also become familiar with full-cost service contracts, as well as with the latest product related services that have been enabled only in recent years by modern IT and mobile technology.

Content
Services are becoming ever more important in business. Today, the gross income share of services in Germany exceeds 70%. Following this trend, many companies that previously focused solely on the sale of goods, strive to an extension of their business model: In order to realize new competitive advantages in domestic and international markets, they enrich their material goods with customer-specific services. This transformation to a provider of integrated solutions is called "Servitization" (Neely 2009). For this reason, so-called industrial services to companies of increasing importance. They benefit from the increasingly detailed data collected (on "Big Data"), e.g. concerning user profiles, failure statistics, usage history, accrued expenses, etc. Only these data allow in principle to end products and spare parts are delivered faster, cheaper and more targeted and technicians can be used more efficiently with the correct skills. This requires, however, also suitable methods of optimization, prognosis or predictive modeling. When used properly, such methods can minimize logistics costs, increase availability, prevent potential failures and improve repair planning. This is also enabled by latest "Technology Enabled Services" along with corresponding data transfer and analysis ("Internet of Things", automatic error detection, remote diagnostics, centralized collection of consumption data, etc.). The change from goods manufacturer to a provider of integrated solutions requires new services, transformation of business models as well as intelligent new contract types, which are addressed in the course as well.
More specifically, the lessons of this lecture will include:

- Servitization – The Manufacturer's Transformationto Integrated Solution Provider
- Service Levels – Definitions, Agreements, Measurements and Service Level Engineering
- The "Services Supply Chain"
- Spare Parts Planning – Forecasting, Assortment Planning, Order Quantities and Safety Stocks
- Distribution Network Planning – Network Types, Models, Optimization
- Service Technician Planning
- Condition Monitoring, Predictive Maintenance, Diagnose Systems
- Call Center Services
- Full Service Contracts
- IT-enabled Value-Add Services – Industrial Service Innovation

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Course: Information Engineering [2122014]

Coordinators: J. Ovtcharova, J. Ovtcharova
Part of the modules: Virtual Engineering B (p. 110)[WI4INGMB30], Virtual Engineering A (p. 109)[WI4INGMB29]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar	Summer term	

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Information Systems in Logistics and Supply Chain Management [2118094]

Coordinators: C. Kilger
Part of the modules: Logistics in Value Chain Networks (p. 108)[WI4INGMB28], Introduction to Logistics (p. 99)[WI4INGMB20], Global Production and Logistics (p. 111)[WI4INGMB31]

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

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

Conditions
Technical understanding is required.

Recommendations
It is recommended to attend the lecuture *Logistics - Organisation, Design, and Control of Logistic Systems.*

Learning Outcomes
Students are able to:

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

Content
1) Overview of logistics systems and processes
2) Basic concepts of information systems and information technology
3) Introduction to IS in logistics: Overview and applications
4) Detailed discussion of selected SAP modules for logistics support

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
presentations

Literature
Stadtler, Kilger: Supply Chain Management and Advanced Planning, Springer, 4. Auflage 2008

Remarks
none

Course: Information Technology and Business Information [2571162]

Coordinators: B. Neibecker
Part of the modules: Strategy, Communication, and Data Analysis (p. 54)[WI4BWLMAR7]

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

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

Conditions
None.

Learning Outcomes
Students have learned the following outcomes and competences:

- To specify the key terms in marketing research
- To design a market research project
- To indentify the main research trends
- To analyze and interpret high level academic articles
- To learn interactive skills to work in teams and to follow a goal-oriented approach
- To gain understanding of methodological research to develop concrete plans for marketing decision-making

Content
The goal of the course is to create a text that is comprehensive, practical, applied, and managerial and that presents a balanced coverage of both, quantitative and qualitative approaches. It takes the perspective of users of marketing research and set out to reflect the current trends in the use of computers (e.g. statistical packages and online research). The course covers as main topics an introduction to interactive mulimedia systems, techniques of internet marketing research, methods of primary data collection including questionnaires and scaling of psychological attributes, methods of observation, program analyzer, psychobiological methods, content analysis and cognitive response approach, experimental designs and panels, secondary data collection, management support systems, a case study in marketing decision support and an overview of philosophy of science. A discussion on tests of scale validity with classical methods and with functional magnetic resonance imaging finishes the course.

Workload
The total workload for this course is approximately 140.0 hours. For further information see German version.

Literature
Backhaus, K., B. Erichson, W. Plinke und R. Weiber: Multivariate Analysemethoden. Berlin et al.: Springer 2010.
Baier, D. und M. Brusch (Hrsg.): Conjointanalyse. Berlin et al.: Springer 2009 (zur Ergänzung).
Baier, D. und B. Neibecker: Ansätze zur Klassifizierung von Zuschauerreaktionen auf Werbespots. In: Baier, D. und R. Decker (Hrsg.): Marketingprobleme, Regensburg: Roderer, 1995, 9-18.
Baron, R. M. und D. A. Kenny: The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations. In: Journal of Personality and Social Psychology 51, 1986, 1173-1182.
Berekoven, L.; W. Eckert; und P. Ellenrieder: Marktforschung. Wiesbaden: Gabler 1996 (12. Aufl. 2009).
Böhler, H.: Marktforschung. Stuttgart et al.: Kohlhammer 1992 (3. Aufl. 2004).
Bruggen, G. H. van, A. Smidts und B. Wierenga: The impact of the quality of a marketing decision support system: An experimental study. International Journal of Research in Marketing, 13, 1996, 331-343.
Bruhn, M.: Multimedia-Kommunikation. München: Beck 1997.
Dietvorst, R. C., W. J. M. I. Verbeke, R. P. Bagozzi, C. Yoon, M. Smits und A. van der Lugt: A Sales Force-Specific Theory-of-Mind Scale: Tests of Its Validity by Classical Methods and Functional Magnetic Resonance Imaging. Journal of Marketing Research, 46, 2009, 653-668.
Dufner, J., U. Jensen und E. Schumacher: Statistik mit SAS. Stuttgart et al.: Teubner 2002.
Friedrichs, J.: Methoden empirischer Sozialforschung. Reinbek: Rowohlt 1990.
Fritz, W.: Internet-Marketing und Electronic Commerce. Wiesbaden: Gabler 2000 (3. Aufl. 2004).
Grabner-Kräuter, S. und C. Lessiak: Der Konsument im Internet – eine Bestandsaufnahme. In: der markt, 37, 1998, 171-186.
Hammann, P. und B. Erichson: Marktforschung. Stuttgart: Lucius & Lucius 2000 (5. Aufl. 2004).
Hüttner, M.: Grundzüge der Marktforschung. München - Wien: Oldenbourg 1997 (7. Aufl. 2002).
Kroeber-Riel, W., P. Weinberg und A. Gröppel-Klein: Konsumentenverhalten. München: Vahlen 2013.
Neibecker, B.: Werbewirkungsanalyse mit Expertensystemen. Heidelberg: Physica 1990.

Neibecker, B.: Beobachtungsmethoden. In: Handwörterbuch des Marketing, Tietz, B.; R. Köhler und J. Zentes (Hrsg.), Stuttgart 1995, 200-211.
Neibecker, B.: Konsumentenemotionen - Messung durch computergestützte Verfahren. Würzburg-Wien: Physica 1985.
Pieters, R. und L. Warlop: Visual Attention during Brand Choice: The Impact of Time Pressure and Task Motivation. In: International Journal of Research in Marketing, 16, 1999, 1-16.
Preacher, K. J. und A. F. Hayes: SPSS and SAS procedures for estimating indirect effects in simple mediation models. In: Behavior Research Methods, Instruments, & Computers, 36, 2004, 717-731.

Course: Infrastructure Equipment of Railway Tracks [6234808]

Coordinators: E. Hohnecker, staff
Part of the modules: Public Transportation Operations (p. 137)[WI4INGBGU26], Track Guided Transport Systems / Engineering (p. 138)[WI4INGBGU27]

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

Learning Control / Examinations
The assessment will consist of a oral exam (10 min) according to §4 (2), 1 of the examination regulation.
The exam is offered each semester. The re-examination is offered upon prior agreement with the interested participants and not later than the next regular examination date.

Conditions
See module description.

Learning Outcomes
See German version.

Content
electrical infrastructure; signalling and telecommunication equipment, track systems

Workload
The total workload for this course is approximately 45.0 hours. For further information see German version.

Remarks
See German version.

Course: Infrastructure Dimensioning and Running Dynamics based Railway Alignment [6234806]

Coordinators: E. Hohnecker, staff
Part of the modules: Track Guided Transport Systems / Engineering (p. 138)[WI4INGBGU27]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	1/1	lecture + exercise	Summer term	de

Learning Control / Examinations
See German version.

Conditions
See module description.

Learning Outcomes
See German version.

Content
calculation of Zimmermann; wheelset-running

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Remarks
See German version.

Course: Geophysical Engineering [2600211/212]

Coordinators: Wenzel, A. Barth
Part of the modules: Understanding and Prediction of Disasters 1 (p. 148)[WI4INGINTER7], Understanding and Prediction of Disasters 2 (p. 149)[WI4INGINTER8]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	1/1	lecture + exercise	Summer term	de

Learning Control / Examinations
The assessment consists of an oral exam taking place in the recess period (according to §4(2), 2 of the examination regulation).

Conditions
None.

Recommendations
None.

Learning Outcomes
see German version

Content
see German version

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Course: Seminar in Engineering Science [SemING]

Coordinators: Fachvertreter ingenieurwissenschaftlicher Fakultäten
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Will be announced in the respective seminar.
Elective literature:
Will be announced in the seminar.

Course: Innovation Management: Concepts, Strategies and Methods [2545015]

Coordinators: M. Weissenberger-Eibl
Part of the modules: Entrepreneurship (EnTechnon) (p. 57)[WI4BWLENT1], Innovation Management (p. 58)[WI4BWLENT2]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

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

Conditions
None.

Learning Outcomes
Students develop a differentiated understanding of the different phases and concepts of the innovation process, different strategies and methods in innovation management.

Content
The course 'Innovation Management: Concepts, Strategies and Methods' offers scientific concepts which facilitate the understanding of the different phases of the innovation process and resulting strategies and appropriate methodologies suitable for application.
The concepts refer to the entire innovation process so that an integrated perspective is made possible. This is the basis for the teaching of strategies and methods which fulfil the diverse demands of the complex innovation process. The course focuses particu-larly on the creation of interfaces between departments and between various actors in a company's environment and the organisation of a company's internal procedures. In this context a basic understanding of knowledge and communication is taught in addi-tion to the specific characteristics of the respective actors. Subsequently methods are shown which are suitable for the profitable and innovation-led implementation of inte-grated knowledge.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Script.

Remarks
This course was formerly named "Innovation Management".

Course: Innovationtheory and -policy [2560236]

Coordinators: I. Ott
Part of the modules: Economic Policy II (p. 64)[WI4VWL3], Innovation and growth (p. 75)[WI4VWLIWW1], Agglomeration and Innovation (p. 70)[WI4VWL13], (p. 77)[WI4VWL19]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise	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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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.

Course: Insurance Marketing [2530323]

Coordinators: E. Schwake
Part of the modules: Insurance Management I (p. 31)[WI4BWLFBV6], Insurance Management II (p. 32)[WI4BWLFBV7]

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

Workload
The total workload for this course is approximately 135.0 hours. For further information 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

Course: Insurance Production [2530324]

Coordinators: U. Werner
Part of the modules: Insurance Management I (p. 31)[WI4BWLFBV6], Insurance Management II (p. 32)[WI4BWLFBV7]

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

Workload
The total workload for this course is approximately 135.0 hours. For further information 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

Course: Insurance Risk Management [2530335]

Coordinators: H. Maser
Part of the modules: Insurance Management II (p. 32)[WI4BWLFBV7], Insurance Management I (p. 31)[WI4BWLFBV6]

ECTS Credits	Hours per week	Type	Term	Instruction language
2,5	2/0	lecture	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

Workload
The total workload for this course is approximately 75.0 hours. For further information see German version.

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: Integrative Strategies in Production and Development of High Performance Cars [2150601]

Coordinators: K. Schlichtenmayer
Part of the modules: Specialization in Production Engineering (p. 101)[WI4INGMB22], Global Production and Logistics (p. 111)[WI4INGMB31]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2	lecture + exercise	Summer term	de

Learning Control / Examinations
The assessment consists of an oral exam taking place in the recess period (according to §4 (2), 2 of the examination regulation). The exam takes place in every semester. Reexaminations are offered at every ordinary examination date.

Conditions
None

Learning Outcomes
The students . . .

- are capable to specify the current technological and social challenges in automotive industry.
- are qualified to identify interlinkages between development processes and production systems.
- are able to explain challenges and solutions of global markets and global production of premium products.
- are able to explain modern methods to identify key competences of producing companies.

Content
The lecture deals with the technical and organizational aspects of integrated development and production of sports cars on the example of Porsche AG. The lecture begins with an introduction and discussion of social trends. The deepening of standardized development processes in the automotive practice and current development strategies follow. The management of complex development projects is a first focus of the lecture. The complex interlinkage between development, production and purchasing are a second focus. Methods of analysis of technological core competencies complement the lecture. The course is strongly oriented towards the practice and is provided with many current examples.
The main topics are:

- Introduction to social trends towards high performance cars
- Automotive Production Processes
- Integrative R&D strategies and holistic capacity management
- Management of complex projects
- Interlinkage between R&D, production and purchasing
- The modern role of manufacturing from a R&D perspective
- Global R&D and production
- Methods to identify core competencies

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).

Literature
Lecture Slides

Course: Integrated production planning [2150660]

Coordinators: G. Lanza
Part of the modules: Integrated Production Planning (p. 103)[WI4INGMB24]

ECTS Credits	Hours per week	Type	Term	Instruction language
9	4/2	lecture + exercise	Summer term	de

Learning Control / Examinations
The assessment is carried out as an written exam according §4(2), 1 SPO. The examination is offered every semester. Reexaminations are offered at every ordinary examination date.

Conditions
None

Recommendations
Attendance of the lecture 'Manufacturing Engineering' [21657] prior to attending this lecture is recommended.

Learning Outcomes
The students . . .

- can discuss basic questions of production technology.
- are able to apply the methods of integrated production planning they have learned about to new problems.
- are able to analyze and evaluate the suitability of the methods, procedures and techniques they have learned about for a specific problem.
- can apply the learned methods of integrated production planning to new problems.
- can use their knowledge targeted for efficient production technology.

Content
As part of this lecture further engineering aspects of production technology are taught. This includes content from the manufacturing technology, machine tools and handling techniques as well as the organization and planning.
Planning factories within the context of value networks and integrated production systems (Toyota etc.) requires an integrated perspective for the consideration of all functions included in the "factory" system. This includes the planning of manufacturing systems including the product, the value network and factory production, and the examination of SOPs, the running of a factory and maintenance. Content and theory covered by this lecture are completed with many examples from industry and exercises based on real-life situations and conditions.
Main topics covered by the lecture:

- The basic principles of production planning
- Links between product planning and production planning
- Integrating a production site into a production network
- Steps and methods of factory planning
- Approach to the integrated planning of manufacturing and assembly plants
- Layout of production sites
- Maintenance
- Material flow
- Digital factory
- Process simulation for material flow optimisation
- Start-up

Workload
regular attendance: 63 hours
self-study: 207 hours

Media
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).

Literature
Lecture Notes

Course: International Management in Engineering and Production [2581956]

Coordinators: H. Sasse
Part of the modules: Industrial Production II (p. 45)[WI4BWLIIP2]

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

Learning Control / Examinations
The examination will be in form of a written exam acc. to §4(2), 1 ER. Exams are offered in every semester and can be re-examined at every ordinary examination date.

Conditions
None.

Learning Outcomes
Students are taught advanced knowledge in the field of international production and the internationalization strategies of manufacturing companies. They acquire a basic understanding of international production companies and learn about the relevant business and economic models and schools of thought on the subject. Different approaches of the design of internationalization strategies and production networks are presented and relevant location factors for their particular design are investigated. Students learn about the risks of internationalization and methods of risk minimization. Issues of supply chain management are discussed in the context of different approaches to the discrete manufacturing and the process industry. The course concludes with selected case studies from the process and discrete manufacturing industry.

Content

- Fundamentals of international business
- Forms of international cooperation and value creation
- Site selection
- Cost driven internationalization and site selection
- Sales and customer driven internationalization and site selection
- Challenges, risks and risk mitigation
- Management of international production sites
- Types and case studies of international production

Workload
The total workload for this course is approximately 105 hours. For further information see German version.

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

Literature
Will be announced in the course.

Remarks
This course was formerly named “International Production”.

Course: International Finance [2530570]

Coordinators: M. Uhrig-Homburg, Dr. Walter
Part of the modules: Finance 3 (p. 28)[WI4BWLFBV11], Finance 2 (p. 27)[WI4BWLFBV2]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	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.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

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. 69)[WI4VWL12], Economic Policy II (p. 64)[WI4VWL3]

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

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

Conditions
None.

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

Learning Outcomes
The student gets aquianted with various modern doctrines and theories pertinent to international economic policy. They shoud understand the structure of the institutional framework relevant for the global economy and the way it functions. They should be able to form their own jugement on the strategies, measures and outcomes of actions of various actors dealing with the international economic policy.

Content

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Elective literature:

- World Bank: "World Development Report". 2008, 2009
- Wagner, M.: „Einführung in die Weltwirtschaftspolitik". Oldenbourg 1995
- Gerber, J.: „International Economics", Pearson, 2007, IV Edition weitere Angaben in der Vorlesung
- Rodrik, D.: "The Globalization Paradox". London 2011.

Remarks
The examination will be offered latest until summer term 2016 (repeaters only).

Course: Cost and Management Accounting [2530210]

Coordinators: T. Lüdecke
Part of the modules: Finance 3 (p. 28)[WI4BWLFBV11], Finance 2 (p. 27)[WI4BWLFBV2]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise	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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Elective literature:

- Coenenberg, A.G. Kostenrechnung und Kostenanalyse, 6. Aufl. 2007.
- Ewert, R. und Wagenhofer, A. Interne Unternehmensrechnung, 7. Aufl. 2008.
- Götze, U. Kostenrechnung und Kostenmanagement. 3. Aufl. 2007.
- Kilger, W., Pampel, J., Vikas, K. Flexible Plankostenrechnung und Deckungsbeitragsrechnung , 11. Aufl. 2002.

Remarks
The examination will be offered latest until summer term 2015 (repeaters only).

Course: Internet Law [24354]

Coordinators: T. Dreier
Part of the modules: Intellectual Property Law (p. 152)[WI4JURA4]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
The students have an overview of the legal rules that are touched upon when the Internet is used as a means of communications and for doing business. These legal rules range from the law governing domain names, issues concerning the electronic formation of contracts, distance and electronic commerce contracts, to the issue liability and questions of unfair competition. Students understand how the legal rules depend upon, and interact with, the economic background, legislative policy and information and communication technologies. Students know the rules of national, European and international copyright law and are able to apply these legal rules in practical cases.

Content
The course deals with the legal rules that are touched upon when the Internet is used as a means of communications and for doing business. These legal rules range from the law governing domain names, issues concerning the electronic formation of contracts, distance and electronic commerce contracts, to the issue liability and questions of unfair competition. Students shall understand how the legal rules depend upon, and interact with, the economic background, legislative policy and information and communication technologies. Students shall learn about the rules of national, European and international copyright law and to apply these legal rules in practical cases.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Slides

Literature
Script, Internetrecht (Internet Law)
Elective literature:
Additional literature tba in class.

Remarks
It is possible that this course will be taught in the summer instead of the winter semester.

Course: IT-Fundamentals of Logistics [2118183]

Coordinators: F. Thomas
Part of the modules: Technical Logistics (p. 106)[WI4INGMB27], Introduction to Logistics (p. 99)[WI4INGMB20]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2	lecture + exercise	Summer term	de

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

Conditions
None.

Recommendations
None.

Learning Outcomes
Students are able to:

- Describe and classify automation technology for material flow and the information technology necessary,
- identify, analyze and design the business processes in internal logistics,
- identify risks of failure and counteract and
- transfer the knowledge to practical implementations.

Content
This lecture, with exercises, treats automation technology in material flow as well as the information technology that has a direct relationship with it. In the first few chapters and exercises, an overview is given of the motors and conveying technology elements used in materials handling, and the sensors required for the purpose are explained. The target control types as well as the topic of coding techniques and RFID (GS1, barcodes, scanner, etc.) are treated in detail. Material flow controls are defined based on these chapters. Among other things, the functions of a stored-memory controller are explained in this section. Hierarchically classified control structures and
their integration in network structures are considered in detail. The principles of communications systems (bus systems etc.) are supplemented with information on the use of the Internet as well as data warehousing strategies. An overview of modern logistics systems, especially in stores administration, illustrates new problem solution strategies in the area of information technology for logistics systems. After an analysis of the causes for system failures, measures are worked
out for reducing the risks of failure. Furthermore, the objectives, task areas as well as various scheduling strategies in the area of transport management and control are presented. Worthwhile information on Europe-wide logistics concepts round off this practice-oriented lecture series. The presentation of the lectures will be multimedia-based. Exercises repeat and extend the knowledge principles imparted in the lectures and illustrate the
subject with practical examples.
Focuses:

- System architecture for logistics solutions / Modularization of conveyors
- Material Flow Control System (MFCS) / Transport Handling
- Coding technique, GS 1 / RFID
- Data communication between controllers, computers and networks
- Business processes for internal logistics – software follows function
- Adaptive IT - Future-oriented software architecture
- System stability and data backup –Software-Engineering
- XTS – The Extensible Transport System

Workload
regular attendance: 21 hours
self-study: 99 hours

Literature
Detailed script can be downloaded online (www.tup.com), updated and enhanced annually.
CD-ROM with chapters and exercises at the end of the semester available from the lecturer, also updated and enhanced annually.

Remarks
See German version.

Course: Introduction to Ceramics [2125757]

Coordinators: M. Hoffmann
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	3/1	lecture + exercise	Winter term	de

Learning Control / Examinations
The assessment consists of an oral exam (30 min) taking place at a specific date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered at a specific date.

Conditions
The course *Material Science I* [21760] has to be completed beforehand.

Recommendations
Basic knowledge of natural science and knowledge of the content *Material Science II* [21782] is recommended.

Learning Outcomes
The students know the most relevant crystal structures and defects of non metallic inorganic materials, are able to read binary and ternary phase diagrams and are familar with powdertechnological shaping techniques, sintering and grain growth. They know the basics of the linear elastic fracture mechanics, are familar with Weibull statistics, K-concept, subcritical crack growth, creep and the opportunities for microstructural reinforcement of ceramics. The students are able to explain the correlation among chemical bonding, crystal and defect structures and the electrical properties of ceramics.

Content
After a short introduction to interatomic bonding, fundamental concepts of crystallography, the stereographic projection and the most important symmetry elements will be given. Different types of crystal structures are explained and the relevance of imperfections are analysed with respect to the mechanical and electrical properties of ceramics. Then, the impact of surfaces, interfaces and grain boundaries for the preparation, microstructural evolution and the resulting properties is discussed. Finally, an introduction is given to ternary phase diagrams.
The second part of the course covers structure, preparation and application aspects of nonmetallic inorganic glasses, followed by an introduction to the properties and processing methods of fine-grained technical powders. The most relevant shaping methods, such as pressing, slip casting, injection moulding and extrusion are introduced. Subsequently, the basics of science of sintering and the mechanisms for normal and abnormal grain growth are discussed. Mechanical properties of ceramics are analysed using basic principles of linear elastic fracture mechanics, Weibull statistics, concepts for subcritical crack growth and creep models to explain the behaviour at elevated temperatures. Furthermore it is demonstrated that mechanical properties can be siginificantly enhanced by various types of microstructural toughening mechanisms. The electronic and ionic conductivity of ceramic materials are explained based on defect-chemical considerations and band structure models. Finally, the characteristics of a dielectric, pyroelectric, and piezoelectric behaviour is discussed.

Workload
regular attendance: 45 hours
self-study: 135 hours

Media
Slides for the lecture:
available under http://ilias.studium.kit.edu

Literature

- H. Salmang, H. Scholze, “Keramik“, Springer
- Kingery, Bowen, Uhlmann, “Introduction To Ceramics“, Wiley
- Y.-M. Chiang, D. Birnie III and W.D. Kingery, “Physical Ceramics”, Wiley
- S.J.L. Kang, “Sintering, Densification, Grain Growth & Microstructure”, Elsevier

Course: Ceramics Processing [2126730]

Coordinators: J. Binder
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

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

Learning Control / Examinations
The assessment consists of an oral exam (20-30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered upon agreement.

Conditions
none

Recommendations
Basic knowledge of experimental physics and chemistry is recommended.
It is recommended to attend the course *Ceramics-Introduction* [2125757].

Learning Outcomes
The students are able to name the major ceramic process technologies and explain their specifics in detail. Additionally, they are capable of illustrating the correlations between the individual processes and their importance for the production of engineering ceramics. The students are able to relate processing effects to material properties. Furthermore the students can apply the basics to concrete tasks. They are able to comprehend and assess information in professional articles.

Content
The course imparts technological basics for processing of engineering ceramics. The course is arranged in the following units:

- Synthesis methods
- Powder conditioning and mixing methods
- Forming of ceramics
- Sintering
- Finishing processes
- Ceramic films and multi-layer systems
- Effects of processing on properties

Workload
regular attendance: 21 hours
self-study: 99 hours

Literature
W. Kollenberg: Technische Keramik, Vulkan Verlag 2010.
M. N. Rahaman: Ceramic Processing, CRC Taylor & Francis, 2007.
D.W. Richerson: Modern ceramic engineering, CRC Taylor & Francis, 2006.
A. G. King: Ceramic Technology and Processing, William Andrew, 2002.

Course: Knowledge Discovery [2511302]

Coordinators: R. Studer
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Winter term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following §4, Abs. 2, 1 of the examination regulation.
Students can be awarded a bonus on their final grade if they successfully complete special assignments.

Conditions
None.

Learning Outcomes
Students

- know fundamentals of Machine Learning, Data Mining and Knowledge Discovery
- are able to design, train and evaluate adaptive systems
- conduct Knowledge Discovery projects in regards to algorithms, representations and applications.

Content
The lecture provides an overview of machine learning and data mining techniques for knowledge discovery from large data sets. These techniques are examined in respect of algorithms, applicability to different data representations and application in the real world.Topics of the lectures comprise the whole Machine Learning and Data Mining process like CRISP, data warehousing, OLAP-techniques, learning algorithms, visualization and empircial evaluation. Covered learning techniques range from traditional approaches like decision trees, neural networks and support vector machines to selected approaches resulting from current research. Discussed learning problems are amongst others feauturevector-based learning, text mining and social network analysis.

Workload

Activity		Effort
Presence Time		
Lecture	(15 x 2 x 45 min)	22h 30min
Exercises	(15 x 1 x 45 min)	11h 15min
Preparation of exercise sheets	(8 x 3h)	24 h
Reading of manuscript	(2 x 20h)	40h
short paper		10h
Rxam preparation		50h
Overall:		157h 45min

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: Convex Analysis [2550120]

Coordinators: O. Stein
Part of the modules: Mathematical Programming (p. 86)[WI4OR6]

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

Learning Control / Examinations
The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation.
The examination is held in the semester of the lecture and in the following semester.
Prerequisite for admission to the written examination is attaining at least 30% of the exercise points. Therefore the online-registration for the written examination is subject to fulfilling the prerequisite.

Conditions
None.

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

Learning Outcomes
The student

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

Content
Convex Analysis deals with properties of convex functions and convex sets, in particular with respect to the minimization of convex functions over convex sets. That the involved functions are not necessarily assumed to be differentiable allows a number a applications which are not covered by techniques from smooth optimization, e.g. approximation problems with respect to the Manhattan or maximum norms, classification problems or the theory of statistical estimates. The lecture develops along another, geometrically simple example, where a nonsmooth obstacle set is to be described by a single smooth convex constraint such that minimal and maximal distances to the obstacle can be computed. The lecture is structured as follows:

- Introductory examples and terminology
- Convex subdifferential, Lipschitz continuity and the safety margin
- Normal cones, error bounds and the maximal distance

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Lecture notes.

Literature
Elective literature:

- J. Borwein, A. Lewis, Convex Analysis and Nonlinear Optimization: Theory and Examples (2 ed.), Springer, 2006.
- S. Boyd, L. Vandenberghe, Convex Optimization, Cambridge University Press, 2004.
- O. Güler, Foundations of Optimization, Springer, 2010.
- J.-B. Hiriart-Urruty, C. Lemarechal, Fundamentals of Convex Analysis, Springer, 2001.
- R.T. Rockafellar, Convex Analysis, Princeton University Press, 1970.
- R.T. Rockafellar, R.J.B. Wets, Variational Analysis, Springer, Berlin, 1998.

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

Course: Hospital Management [2550493]

Coordinators: S. Nickel, Hansis
Part of the modules: Operations Research in Supply Chain Management and Health Care Management (p. 84)[WI4OR5]

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

Learning Control / Examinations
The assessment consists of attendance, a seminar thesis and a final exam (according to §4(2), 1 of the examination regulation). The examination is held in the term of the lecture and the following lecture.

Conditions
See German version.

Learning Outcomes
The student

- understands the principles of work flows in hospitals,
- utilizes Operations Research methods in so-called non-profit-organisations to improve service qualities,
- explains, classifies and deals with the most important application areas for mathematical models, e.g. personnel planning or quality management.

Content
The lecture “Hospital management“ presents internal organization structures, work conditions and work environments at the example of hospitals und relates this to common and expected conditions of other service industries.
Covered topics include normative environment, intra-organizational structure, personnel management, quality, external networking and market appearance. Students have the possibility to participate in a final exam.

Workload
The total workload for this course is approximately 135 hours. For further information see German version.

Remarks
The credits have been changed from 3 to 4,5.
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. 27)[WI4BWLFBV2], Finance 3 (p. 28)[WI4BWLFBV11]

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

Learning Control / Examinations
The assessment consists of a written exam following §4, Abs. 2, 1.

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature

- Lando, D., Credit risk modeling: Theory and Applications, Princeton Univ. Press, (2004).
- Uhrig-Homburg, M., Fremdkapitalkosten, Bonitätsrisiken und optimale Kapitalstruktur, Beiträge zur betriebswirtschaftlichen Forschung 92, Gabler Verlag, (2001).

Elective literature:

- Bluhm, C., Overbeck, L., Wagner, C. , Introduction to Credit Risk Modelling, 2nd Edition, Chapman & Hall, CRC Financial Mathematics Series, (2010).
- Duffie, D., Singleton, K.J., Credit Risk: Pricing, Measurement and Management, Princeton Series of Finance, Prentice Hall, (2003).

Course: Warehousing and distribution systems [2118097]

Coordinators: M. Schwab, J. Weiblen

Part of the modules: Material Flow in Logistic Systems (p. 104)[WI4INGMB25], Material Flow in Networked Logistic Systems (p. 105)[WI4INGMB26], Logistics in Value Chain Networks (p. 108)[WI4INGMB28], Technical Logistics (p. 106)[WI4INGMB27], Introduction to Logistics (p. 99)[WI4INGMB20]

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

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

Conditions
None.

Recommendations
None.

Learning Outcomes
Students are able to:

- Describe the areas of typical warehouse and distribution systems with the respective processes and can illustrate it with sketches,
- Use and choose strategies of warehouse and distribution systems according to requirements,
- Classify typical systsems using criteria discussed in the lecture, and
- Reson about the choice of appropriate technical solutions.

Content

- Introduction
- Yard management
- Receiving
- Storage and picking
- Workshop on cycle times
- Consoldiation and packing
- Shipping
- Added Value
- Overhead
- Case Study: DCRM
- Planning of warehouses
- Case study: Planning of warehouses
- Distribution networks
- Lean Warehousing

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
presentations, black board

Literature
ARNOLD, Dieter, FURMANS, Kai (2005)
Materialfluss in Logistiksystemen, 5. Auflage, Berlin: Springer-Verlag
ARNOLD, Dieter (Hrsg.) et al. (2008)
Handbuch Logistik, 3. Auflage, Berlin: Springer-Verlag
BARTHOLDI III, John J., HACKMAN, Steven T. (2008)
Warehouse Science

GUDEHUS, Timm (2005)
Logistik, 3. Auflage, Berlin: Springer-Verlag
FRAZELLE, Edward (2002)
World-class warehousing and material handling, McGraw-Hill
MARTIN, Heinrich (1999)
Praxiswissen Materialflußplanung: Transport, Hanshaben, Lagern, Kommissionieren, Braunschweig, Wiesbaden: Vieweg
WISSER, Jens (2009)
Der Prozess Lagern und Kommissionieren im Rahmen des Distribution Center Reference Model (DCRM); Karlsruhe : Universitätsverlag
A comprehensive overview of scientific papers can be found at:
ROODBERGEN, Kees Jan (2007)
Warehouse Literature

Remarks
none

Course: Laser Physics [23840]

Coordinators: M. Eichhorn
Part of the modules: Optoelectronics and Optical Communication (p. 125)[WI4INGMBIMT6], Microoptics (p. 120)[WI4INGMBIMT3]

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

Learning Control / Examinations
The assessment will consist of a oral exam (30 min) (following §4 (2), 2 of the examination regulation).

Conditions
None.

Learning Outcomes

- Knows the fundamental relations and background of lasers
- Has the necessary knowledge for understanding and dimensioning of Lasers, laser media, optical resonators and pump strategies
- Understands the pulse fabrication with lasers and their fundamentals
- has the necessary knowledge of several lasers; Gas-, solid state, fibers- and disc- lasers in the visible and middle infrared range

Content
1 Quantum-mechanical fundamentals of lasers
1.1 Einstein relations and Planck's law
1.2 Transition probabilities and matrix elements
1.3 Mode structure of space and the origin of spontaneous emission
1.4 Cross sections and broadening of spectral lines
2 The laser principle
2.1 Population inversion and feedback
2.2 Spectroscopic laser rate equations
2.3 Potential model of the laser
3 Optical Resonators
3.1 Linear resonators and stability criterion
3.2 Mode structure and intensity distribution
3.3 Line width of the laser emission
4 Generation of short and ultra-short pulses
4.1 Basics of Q-switching
4.2 Basics of mode locking and ultra-short pulses
5 Laser examples and their applications
5.1 Gas lasers: The Helium-Neon-Laser
5.2 Solid-state lasers
5.2.1 The Nd3+-Laser
5.2.2 The Tm3+-Laser
5.2.3 The Ti3+:Al2O3 Laser
5.3 Special realisations of lasers
5.3.1 Thermal lensing and thermal stress
5.3.2 The fiber laser
5.3.3 The thin-disc laser

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Script & tutorial of lecturer

Literature

- A. E. Siegman, *Lasers*, (University Science Books).
- B. E. A. Saleh, M. C. Teich, *Fundamentals of Photonics* (Wiley-Interscience).
- F. K. Kneubühl, M. W. Sigrist, *Laser* (Teubner).

Course: Laser in automotive engineering [2182642]

Coordinators: J. Schneider
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

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

Learning Control / Examinations
The assessment consists of an oral exam (30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered upon agreement.

Conditions
Basic knowledge of physics, chemistry and material science is assumed.
It is not possible, to combine this lecture with the lecture *Physical Basics of Laser Technology* [2181612]

Recommendations
None.

Learning Outcomes
The student

- can explain the principles of light generation, the conditions for light amplification as well as the basic structure and function of Nd:YAG-, CO_2- and high power diode-laser sources.
- can describe the most important methods of laser-based processing in automotive engineering and illustrate the influence of laser, material and process parameters
- can analyse manufacturing problems and is able to choose a suitable laser source and process parameters.
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Content
Based on a short description of the physical basics of laser technology the lecture reviews the most important high power lasers and their various applications in automotive engineering. Furthermore the application of laser light in metrology and safety aspects will be addressed.

- physical basics of laser technology
- laser beam sources (Nd:YAG-, CO_2-, high power diode-laser)
- beam properties, guiding and shaping
- basics of materials processing with lasers
- laser applications in automotive engineering
- economical aspects
- savety aspects

Workload
regular attendance: 22,5 hours
self-study: 97,5 hours

Media
lecture notes via ILIAS

Literature
W. M. Steen: Laser Material Processing, 2010, Springer
W. T. Silfvast: Laser Fundamentals, 2008, Cambridge University Press

Remarks
It is allowed to select only one of the lectures “Laser in automotive engineering” (2182642) or “Physical basics of laser technology” (2181612) during the Bachelor and Master studies.

Course: Food Science and Functionality [22207]

Coordinators: Watzl
Part of the modules: Principles of Food Process Engineering (p. 144)[WI4INGCV3], Specialization in Food Process Engineering (p. 145)[WI4INGCV4]

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

Learning Control / Examinations
See module description.

Conditions
None.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Course: Logistics - organisation, design and control of logistic systems [2118078]

Coordinators: K. Furmans
Part of the modules: Logistics in Value Chain Networks (p. 108)[WI4INGMB28]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	3/1	lecture + exercise	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam according to Section 4 (2), 1 of the examination regulation. The grade of the exam may be improved by passing case studies.

Conditions
None.

Recommendations
Requied are lectures on "Linear Algebra" and "Stochastic".

Learning Outcomes
Students are able to:

- Describe logistical tasks,
- Design logistical systems suitable to the respective task,
- Dimension stocastical stock models,
- Determine essential influencing parameters on the bullwhip effect and
- Use optimizing solution methods.

Content
multistage logistic process chains
transport chain in logistic networks
distribution processes
distribution centers
logistics of production systems
dependencies between production and road traffic
information flow
cooperative strategies (like kanban, just-in-time, supply chain management)

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

Media
presentations, black board

Literature
None.

Remarks
none

Course: Automotive Logistics [2118085]

Coordinators: K. Furmans
Part of the modules: Material Flow in Logistic Systems (p. 104)[WI4INGMB25], Material Flow in Networked Logistic Systems (p. 105)[WI4INGMB26], Global Production and Logistics (p. 111)[WI4INGMB31], Logistics in Value Chain Networks (p. 108)[WI4INGMB28], Introduction to Logistics (p. 99)[WI4INGMB20]

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

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

Conditions
None.

Recommendations
None.

Learning Outcomes
Students are able to:

- Describe essential logistic questions, in a complex production network. As an example the automobile industry is used.
- Choose and apply solution possibilities for logistic problems in this area.

Content

- Logistic questions within the automobile industry
- basic model of automobile production and distribution
- relation with the suppliers
- Disposition and physical execution
- Vehicle production in the interaction of shell, paint shop and assembly
- Sequence planning
- Assembly supply
- vehicle distribution and linkage with selling processes
- Physical execution, planning and control

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
presentations, black board

Literature
None.

Remarks
none

Course: Airport logistics [2117056]

Coordinators: A. Richter
Part of the modules: Material Flow in Logistic Systems (p. 104)[WI4INGMB25], Material Flow in Networked Logistic Systems (p. 105)[WI4INGMB26], Logistics in Value Chain Networks (p. 108)[WI4INGMB28], Introduction to Logistics (p. 99)[WI4INGMB20]

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

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

Conditions
none

Recommendations
None.

Learning Outcomes
Students are able to:

- Describe material handling and informations technology activities on airports,
- Evaluate processes and systems on airports as the law stands, and
- Choose appropriate processes and material handling systems for airports.

Content
Introduction
airport installations
luggage transport
passenger transport
security on the airport
legal bases of the air traffic
freight on the airport

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
presentations

Literature
None.

Remarks
Limited number of participants: allocation of places in sequence of application (first come first served)
Application via “ILIAS” mandatory
personal presence during lectures mandatory

Course: Markets and Organizations: Principles [2540502]

Coordinators: A. Geyer-Schulz
Part of the modules: Electronic Markets (p. 39)[WI4BWLISM2]

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

Learning Control / Examinations
Assessment consists of a written exam of 1 hour length following §4 (2), 1 of the examination regulation and by submitting written papers as part of the exercise following §4 (2), 3 of the examination regulation.
The course is considered successfully taken, if at least 50 out of 100 points are acquired in the written exam. In this case, all additional points (up to 10) from excersise work will be added. The grades of this lecture are assigned following the table below:

Grade	Minimum points
1.0	95
1.3	90
1.7	85
2.0	80
2.3	75
2.7	70
3.0	65
3.3	60
3.7	55
4.0	50
5.0	0

Conditions
None.

Learning Outcomes
The student

- has an overview about the different organizational form and their efficiency,
- names coodination methods and motivation methods and evaluates them regarding their efficiency,
- knows, in the context of markets as a coordination form, the conditions under which markets are not efficient (market failure),
- knows phenomena like adverse selections and moral hazard,
- names reasons for these phenomena and develops methods to encounter them.

Content
What are the conditions that make markets develop? The first part of the lecture treats the selection of the type of organization as an optimization of transaction costs. The second part includes the efficiency of markets (price, information and allocation efficiency) as well as reasons for market failure.
Besides a centralistic approach, markets can be used for decentral coordination of plans and activities. Hereby, optimality can be garuanteed, if the coordination problem has no design or innovation characteristics. Viewed from a bottom-up perspective, given the coordination problem, it is possible to answer questions regarding the centralization or decentralization, the design of coordination mechanisms, and the coherence of business strategies. The last part of the lecture consists of motivation problems, like bounded rationality and information assymetries (private information and moral hazard) and the development of incentive systems.

Workload
The total workload for this lecture will amount to approximately 135 hours (4.5 credits).

Activity		Workload
Attendance time		
Attendance of lecture	15 x 90min	22h 30m
Attendance of exercise	7 x 90min	10h 30m
Self-study		
Preparation of lecture		22h 30m
Wrap-up of lecture		22h 30m
Preparation of excercise		25h 00m
Preparation of assessment		31h 00m
Assessment		1h 00m
Sum		135h 00m

Literature
Kapitel “Management Control Systems, Dezentralisierung, interne Märkte und Transferpreise” (S. 745-773) in Charles T. Horngren, Srikant M. Datar, and George Foster. Cost Accounting: A Managerial Emphasis. Prentice Hall, Upper Saddle River, 11 edition, 2003.
Paul Milgrom and John Roberts. Economics, Organisation and Management. Prentice Hall, 1 edition, 1992.
Elective literature:
Michael Dell and Catherine Fredman. Direct from DELL: Strategies that Revollutionized an Industry. Harper Collins Publisher, London, 1999.
Andreas Geyer-Schulz, Michael Hahsler, and Maximillian Jahn. Educational and scientific recommender systems: Designing the information channels of the virtual university. International Journal of Engineering Education, 17(2):153 – 163, 2001.
Friedrich A. Hayek. The use of knowledge in society. The American Economic Review, 35(4):519 – 530, Sep 1945.
Norbert Hochheimer. Das kleine QM-Lexikon. Wiley-UCH, Weinheim, 2002.
Adam Smith. An Inquiry into the Nature and Causes of the Wealth of Nations, volume II. 1976.

Remarks
The course is not offered at the moment. The last exam takes place at the end of summer term 14.

Course: Management Accounting 1 [2579900]

Coordinators: M. Wouters
Part of the modules: Management Accounting (p. 35)[WI4BWLIBU1]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/2	lecture + exercise	Summer term	en

Learning Control / Examinations
The assessment consists of a written exam (90 minutes) (following §4(2), 1 of the examination regulation) at the end of each semester.

Conditions
None.

Learning Outcomes
Students have an understanding of theory and applications of management accounting topics. They can use financial information for various purposes in organizations.

Content
The course covers topics in management accounting in a decision-making framework. Some of these topics in the course MA1 are: short-term planning, investment decisions, budgeting and activity-based costing.
We will use international material written in English.
We will approach these topics primarily from the perspective of the users of financial information (not so much from the controller who prepares the information).
The course builds on an introductory level of understanding of accounting concepts from Business Administration courses in the core program. The course is intended for students in Industrial Engineering.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
The recorded lectures and the teaching materials are available on Ilias during the current and next semester.

Literature

- Marc Wouters, Frank H. Selto, Ronald W. Hilton, Michael W. Maher: Cost Management – Strategies for Business Decisions, 2012, Publisher: McGraw-Hill Higher Education (ISBN-13 9780077132392 / ISBN-10 0077132394)
- In addition, several papers that will be available on ILIAS.

Course: Management Accounting 2 [2579902]

Coordinators: M. Wouters
Part of the modules: Management Accounting (p. 35)[WI4BWLIBU1]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/2	lecture + exercise	Winter term	en

Learning Control / Examinations
The assessment consists of a written exam (90 minutes) (following §4(2), 1 of the examination regulation) at the end of each semester.

Conditions
None.

Recommendations
It is recommended to take part in the course “Management Accounting 1” before this course.

Learning Outcomes
Students have an understanding of theory and applications of management accounting topics. They can use financial information for various purposes in organizations.

Content
The course covers topics in management accounting in a decision-making framework. Some of these topics in the course MA2 are: cost estimation, product costing and cost allocation, financial performance measures, transfer pricing, strategic performance measurement systems and customer value propositions.
We will use international material written in English.
We will approach these topics primarily from the perspective of the users of financial information (not so much from the controller who prepares the information).
The course builds on an introductory level of understanding of accounting concepts from Business Administration courses in the core program. The course is intended for students in Industrial Engineering.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
The recorded lectures and the teaching materials are available on ILIAS during the current and next semester.

Literature

- Marc Wouters, Frank H. Selto, Ronald W. Hilton, Michael W. Maher: Cost Management – Strategies for Business Decisions, 2012, Publisher: McGraw-Hill Higher Education (ISBN-13 9780077132392 / ISBN-10 0077132394)
- In addition, several papers that will be available on ILIAS.

Course: Management in Public Transport [6234805]

Coordinators: E. Hohnecker
Part of the modules: Public Transportation Operations (p. 137)[WI4INGBGU26], Project in Public Transportation (p. 136)[WI4INGBGU25]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
The assessment will consist of a oral exam (20 min) according to §4 (2), 1 of the examination regulation.
The exam is offered each semester. The re-examination is offered upon prior agreement with the interested participants and not later than the next regular examination date.

Conditions
See module description.

Learning Outcomes
See German version.

Content
See German version.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Remarks
See German version.

Course: Managing New Technologies [2545003]

Coordinators: T. Reiß
Part of the modules: Entrepreneurship (EnTechnon) (p. 57)[WI4BWLENT1]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Summer term	de

Learning Control / Examinations
Written exam 100% following §4, Abs. 2.

Conditions
None.

Learning Outcomes
New technologies can contribute substantially to the international competitiveness of different industrial sectors. This course provides the necessary knowledge for understanding how industrial enterprises and policy-makers are dealing with the challenge to realise in time the potentials of new technologies and to use them most efficiently. Key tasks of the management of new technologies will be practised.

Content
The course provides an overview of the international development of a selected number of key technologies such as biotechnology, nanotechnology, neurotechnologies, converging technologies. Methods for monitoring new technologies including foresight approaches will be presented and the economic and social impacts of new technologies will be discussed.

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Media
Slides.

Literature

- Hausschildt/Salomo: Innovationsmanagement; Borchert et al.: Innovations- und Technologiemanagement;
- Specht/Möhrle; Gabler Lexikon Technologiemanagement

Course: Management of IT-Projects [2511214]

Coordinators: R. Schätzle
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Summer term	de

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

Conditions
None.

Learning Outcomes
Students

- explain the terminology of IT project management and typical used methods for planning, handling and controlling,
- apply methods appropiate to current project phases and project contexts,
- consider organisational and social impact factors.

Content
The lecture deals with the general framework, impact factors and methods for planning, handling, and controlling of IT projects. Especially following topics are addressed:

- project environment
- project organisation
- project planning including the following items:
  - plan of the project structure
  - flow chart
  - project schedule
  - plan of resources
- effort estimation
- project infrastructur
- project controlling
- risk management
- feasibility studies
- decision processes, conduct of negotiations, time management.

Workload
Lecture 30h
Exercise 15h

Preparation of lecture 30h
Preparation of exercises 30h
Exam preparation 44h
Exam &1h

Total: 150h

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: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Winter term	de

Learning Control / Examinations
see German version.

Conditions
see German version.

Learning Outcomes
see German version.

Content
see German version

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Literature
Elective literature:
Will be announced in the lecture.

Course: Trademark and Unfair Competition Law [24136 / 24609]

Coordinators: Y. Matz
Part of the modules: Intellectual Property Law (p. 152)[WI4JURA4]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
The students have competent knowledge in the area of trademark rights in the national as well as the European and International context, The students have good capabilities especially with the procedures of registration and the claims, which result from the infringements of trademark rights, as well as with the right of other marks in the MarkenG

Content
The course deals with the subject matter of trademark rights: what is a trademark, how can I get the registration of a trademark, what rights and claims do owner of trademarks have, which other marks do exist? The students shall learn about the rules of national, European an international trademark law.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature

- Berlit, Wolfgang: Markenrecht, Verlag C.H.Beck, ISBN 3-406-53782-0, neueste Auflage.

Course: Market Engineering: Information in Institutions [2540460]

Coordinators: C. Weinhardt
Part of the modules: Information Engineering (p. 44)[WI4BWLISM7], Applied Strategic Decisions (p. 63)[WI4VWL2], Market Engineering (p. 41)[WI4BWLISM3], Electronic Markets (p. 39)[WI4BWLISM2]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise	Summer 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) up to 6 bonus points can be obtained. The bonus points only apply to the first and second exam of the semester in which they were obtained.

Conditions
None.

Learning Outcomes
The students

- understand the role of an economist as an engineer to design markets,
- compare different markets and market mechanisms to evaluate their efficiency,
- apply game theoretic modelling and mechanism design as well as auction theory for interdisciplinary evaluation.

Content
The ongoing advancements in information technology have revolutionized traditional business processes and given rise to electronic marketplaces. In contrast to physical marketplaces, electronic markets do not just evolve, but must be carefully designed, implemented and monitored and evaluated. Moreover electronic markets demand open and flexible platforms as well as adequate standards and information services. Future Market Engineers must therefore be able to consider the economic, legal and technological dimension of markets simultaneously. The lecture focuses on the discussion of (1) Microstructure, (2) IT infrastructure, and (3) Business Structure of electronic markets. Hence, students will be taught the economic incentives that a market can impose on market participants, development models for implementing markets, and business models for the application of markets.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media

- PowerPoint
- E-learning platform ILIAS

Literature

- Roth, A., The Economist as Engineer: Game Theory, Experimental Economics and Computation as Tools for Design Economics. Econometrica 70(4): 1341-1378, 2002.
- Weinhardt, C. ,Holtmann, C., Neumann, D., Market Engineering. Wirtschaftsinformatik, 2003.
- Wolfstetter, E., Topics in Microeconomics - Industrial Organization, Auctions, and Incentives. Cambridge, Cambridge University Press, 1999.
- Smith, V. „Theory, Experiments and Economics“, The Journal of Economic Perspectives,Vol. 3, No. 1, 151-69 1989

Course: Marketing Analytics [2572170]

Coordinators: M. Klarmann
Part of the modules: Evidence-based Marketing (p. 55)[WI4BWLMAR8]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise	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)

Conditions
In order to attend Marketing Analytics, students are required to have passed the course Market Research [2571150].

Learning Outcomes
Students

- receive based on the course market research an overview of advanced empirical methods
- learn in the course of the lecture to handle advanced data collection and data analysis methods
- are based on the acquired knowledge able to interpret results and derive strategic implications

Content
In this course various relevant market research questions are addressed, as for example measuring and understanding customer attitudes, preparing strategic decisions and sales forecasting. In order to analyze these questions, students learn to handle social media data, panel data, nested observations and experimental design. To analyze the data, advanced methods, as for example multilevel modeling, structural equation modeling and return on marketing models are taught. Also, problems of causality are addressed in-depth. The lecture is accompanied by a computer-based exercise, in the course of which the methods are applied practically.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Script

Literature
References will be given in the course.

Remarks
For further information please contact the Marketing & Sales Research Group (marketing.iism.kit.edu).
Exchange students can bypass the requirement of passing Market Research if they can prove that they possess sufficient statistical knowledge based on courses attended at their home institution. This will be examined individually by the Marketing & Sales Research Group.

Course: Marketing Strategy Business Game [2571176]

Coordinators: M. Klarmann, Mitarbeiter
Part of the modules: Marketing Management (p. 51)[WI4BWLMAR5], Cross-functional Management Accounting (p. 36)[WI4BWLIBU2]

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

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
Students
- are able to operate the strategic marketing simulation software "Markstrat"
- are able to take strategic marketing decisions in groups
- know how to apply strategic marketing concepts to practical contexts (e.g. for market segmentation, product launches, coordination of the marketing mix, market research, choice of the distribution channel or competitive behavior)
- are capable to collect and to select information usefully with the aim of decision-making
- are able to react appropriately to predetermined market conditions
- know how to present their strategies in a clear and consistent way
- are able to talk about the success, problems, critical incidents, external influences and strategy changes during the experimental game and to reflect and present their learning success

Content
Using Markstrat, a marketing strategy business game, students work in groups representing a company that competes on a simulated market against the other groups' companies.

Workload
The total workload for this course is approximately 45.0 hours. For further information see German version.

Remarks
For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).
Please note: The number of participants for this course is limited. The Marketing & Sales Research Group typically provides the possibility to attend a course with 1,5 ECTS in the respective module to all students. Participation in a specific course cannot be guaranteed.

Course: Marketing Communication [2540440]

Coordinators: J. Kim
Part of the modules: Marketing Management (p. 51)[WI4BWLMAR5], Services Marketing (p. 56)[WI4BWLMAR9]

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

Learning Control / Examinations
The assessment consists of a written examination (60 min) (according to Section 4 (2),1 of the examination regulation).

Conditions
None.

Learning Outcomes
Students

- get to know marketing communications objectives and strategies
- gain knowledge about positioning and integrated marketing communications as part of advertising strategy
- know how to apply social-technique rules on advertising
- learn techniques for measuring the advertising effects from activation through to actual behavior
- learn about online marketing instruments and how to measure their success
- learn about budgeting models and media planning
- learn about economic and behavioral theories of promotions
- gain knowledge about CSR and how it is connected to marketing

Content
The aim of this lecture is to provide an overview of research on marketing communication tools, such as offline and online advertising, budgeting and media planning, price promotions and corporate social responsibility activities.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Lecture slides will be provided in ILIAS

Literature

- Esch, F-R./Herrmann, A./Sattler, H. "Marketing – Eine managementorientierte Einführung"
- Kroeber-Riel, W./Esch, F-R. "Strategie und Technik der Werbung"
- Fuchs, W./Unger, F. (2007): „Management der Marketing Kommunikation"
- Stokes, Rob (2012), "eMarketing: The Essential Guide to Online Marketing," hier erhältlich:http://students.flatworldknowledge.com/cou
- Gedenk, Karen (2002), "Verkaufsförderung"

See lecture slides for further recommendations on literature

Remarks
New course starting summer term 2015.
The credits for the course have been changed from 3 to 4,5 from summer term 2016 on.

Course: Market Research [2571150]

Coordinators: M. Klarmann
Part of the modules: Marketing Management (p. 51)[WI4BWLMAR5], Evidence-based Marketing (p. 55)[WI4BWLMAR8], Sales Management (p. 53)[WI4BWLMAR6]

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

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

Conditions
Please note that this course has to be completed successfully by students interested in seminar or master thesis positions at the chair of marketing.

Learning Outcomes
Topics addressed in this course are for example:

Theoretical principles of market research
Statistical foundations of market research
Measuring customer attitudes
Understanding of customer reactions
Strategical decision making

Content
Topics addressed in this course are for example:

- Theoretical foundations of market research
- Statistical foundations of market research
- Measuring customer attitudes
- Understanding customer reactions
- Strategical decision making

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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. 28)[WI4BWLFBV11], Finance 2 (p. 27)[WI4BWLFBV2]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2/0	lecture	Winter term	de

Learning Control / Examinations

Conditions
Knowledge of the content of the course *Asset Pricing* [2530555] is assumed.

Learning Outcomes
This lecture makes students familiar with the fundamental models of trading in financial markets. It starts with generic design features of financial markets which are used to frame price discovery as the key element of the trading process. The link between market design and market quality is pointed out by using alternative measures of market quality. Seminal models of market microstructure are used to show how dealer inventoy and/or asymmetric information affect market prices and the pricing of securities. Theoretical models are shown to provide predictions which are consistent with empiricial evidence.

Content
The focus of this lecture is on the question how the microstructure of financial markets affects price discovery and market quality. First, issues in designing market structure are presented and linked to fundamental dimensions of market quality, i.e liquidity and trading costs. In particular, the services and privileges of market makers are stressed. The main part of the lecture covers inventory-models of dealer markets and models of information-based trading. The final part gives attention to some econometric models to analyze the short-term behavior of security prices.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Slides.

Literature
keine
Elective literature:
See reading list.

Remarks
This lecture will not be provided any more. The examination will be offered latest until winter term 2015/2016 (repeaters only).

Course: Construction Equipment [6241703]

Coordinators: S. Gentes
Part of the modules: Process Engineering in Construction (p. 135)[WI4INGBGU22]

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

Learning Control / Examinations
The assessement consists of a written exam (30 minutes) (following §4(2), 1 of the examination regulation).

Conditions
None.

Learning Outcomes
Students

- gain fundamental knowledge about modes of operation of several drive technologies with a focus on construction equipment
- understand foundations of hydraulic systems in construction equipment
- gain the ability to determine and size transmission elements of construction equipment and machinery.

Content
The lecture comprises

- drive technology (basics,performance improvement, energy utilization)
- transmission elements (coupler, rope, chain, axle, gear technology, automatic gear box)
- Basics of hydraulic systems

Workload
The total workload for this course is approximately 90.0 hours. For further information see German version.

Media
Lecture slides.

Remarks
This course was formerly named "Fundamental Mechanics of Construction Equipment".
The credits have been changed from 1,5 to 3.

Course: Master Seminar in Information Engineering and Management [2540510]

Coordinators: A. Geyer-Schulz
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar	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 and a presentation.
The grade is given, if the presentation is held and the seminar thesis is handed in.
The grade of this course is based on the grade of the seminar thesis. The presentation can improve or worsen the grade of the seminar thesis by up to two grade levels (up to 0.7 grades).

Conditions
None.

Learning Outcomes
The student is able to

- to perform a literature search for a given topic, to identify, find, value and evaluate the relevant literature.
- to commit to a topic (pr.n., in teamwork); this may include technical conceptinal work and implementation.
- to write his seminar thesis of 15-20 pages in a structured scientific manner.
- to communicate his results in a presentation with discussion afterwards.

Content
The seminar servers on one hand to improve the scientific working skills. On the other hand, the student should work intensively on a given topic and develop a scientific work, that is based on a profound literature research.
The seminar can also be a implementation of software for a scientific problem (e.g. Business Games/dynamic systems) according to the individual focus in the current semester. The software has to be well documented. The written elaboration covers a description and explanation of the software as well as a discussion about limits and extensibility. Furthermore the software must be deployable und shall be presented on the infrastructure stack of the chair. An implementation of a software has to examine the scientific state of the art in a critical way, too.
A concrete description of the current topics is announced in time for the begin of the application stage.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Material flow in logistic systems [2117051]

Coordinators: K. Furmans
Part of the modules: Introduction to Logistics (p. 99)[WI4INGMB20], Material Flow in Logistic Systems (p. 104)[WI4INGMB25]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	3/1	lecture + exercise	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam according to Section 4 (2), 1 of the examination regulation. The grade of the exam may be improved by passing case studies.

Conditions
None.

Recommendations
None.

Learning Outcomes
Students are able to:

- describe material flow processes qualitativ and quantitativ,
- assign possibilities of technical solutions to a open operational task,
- plan material flow systems, illustrate them in simple models and analyse them regarding their performance,
- use methods to determine performance indicators like throughput, utilization, etc., and
- evaluate material flow systems regarding performance and availability.

Content

- elements of material flow systems (conveyor elements, fork, join elements)
- models of material flow networks using graph theory and matrices
- queueing theory, calculation of waiting time, utilization
- warehouseing and order-picking
- shuttle systems
- sorting systems
- simulation
- calculation of availability and reliability
- value stream analysis

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

Media
presentations, black board, book

Literature
Arnold, Dieter; Furmans, Kai : Materialfluss in Logistiksystemen; Springer-Verlag Berlin Heidelberg, 2009

Remarks
none

Course: Materials and Processes for Body Lightweight Construction in the Automotive Industry [2149669]

Coordinators: D. Steegmüller, S. Kienzle
Part of the modules: Specialization in Production Engineering (p. 101)[WI4INGMB22]

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

Learning Control / Examinations
The assessment consists of an oral exam taking place in the recess period (according to §4 (2), 2 of the examination regulation). The exam takes place in every semester. Reexaminations are offered at every ordinary examination date.

Conditions
None

Recommendations
None

Learning Outcomes
The students . . .

- are able to name the various lightweight approaches and identify possible areas of application.
- are able to identify the different production processes for manufacturing lightweight structures and explain their functions.
- are able to perform a process selection based on the methods and their characteristics.
- are able to evaluate the different methods against lightweight applications on the basis of technical and economic aspects.

Content
The objective of the lecture is to build up an overview of the relevant materials and processes for the production of a lightweight body. This includes both the actual production and the joining for the body. The lecture covers the different lightweight approaches and possible fields of application in the automotive industry. The methods are discussed with practical examples from the automotive industry.
The following topics will be covered:

- lightweight designs
- aluminum and steel for lightweight construction
- fibre-reinforced plastics by the RTM and SMC process
- joining of steel and aluminum (clinching, riveting, welding)
- bonding
- coating
- finishing
- quality assurance
- virtual factory

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).

Literature
Lecture Notes

Remarks
None

Course: Mathematical models and methods for Production Systems [2117059]

Coordinators: K. Furmans, J. Stoll
Part of the modules: Material Flow in Networked Logistic Systems (p. 105)[WI4INGMB26]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	3/1	lecture + exercise	Winter term	en

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

Conditions
None.

Recommendations
The content of a course about “stochastics” is recommended.

Learning Outcomes
Students are able to:

- Describe material flow systems with analytical solvable stochastic models,
- Derive Approches for control systems (KANBAN) based on easy models of queueing theory,
- Execute practical exercised on workstations and
- Use simulation and exakt methods.

Content

- single server systems: M/M/1, M/G/1: priority rules, model of failures
- networks: open and closed approximations, exact solutions and approximations
- application to flexible manufacturing systems, AGV (automated guided vehicles) - systems
- modeling of control approaches like constant work in process (ConWIP) or kanban
- discrete-time modeling of queuing systems

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

Media
black board, lecture notes, presentations

Literature
Wolff: Stochastic Modeling and the Theory of Queues, Prentice Hall, 1989

Shanthikumar, Buzacott: Stochastic Models of Manufacturing Systems

Remarks
none

Course: Mathematical Theory of Democracy [2525537]

Coordinators: A. Melik-Tangyan
Part of the modules: Collective Decision Making (p. 73)[WI4VWL16]

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

Learning Control / Examinations
The assessment consists of a written exam (120 min.) according to §4 (2), 1 of the examination regulation. It may be an oral exam (20 - 30 min.) (according to §4 (2), 2 of the examination regulation) in the case of poor attendance.

Conditions
None.

Recommendations
None.

Learning Outcomes
The student understands the foundations of democracy and the implementation problems and the masters the operationalization of the problems by mathematical models

Content
The mathematical theory of democracy deals with the selection of representatives who make decisions on behalf of the whole society. The concept of representation is operationalized with the popularity index (average percentage of the population represented on a number of issues), and with the universality index (percentage of cases when a majority of the population is represented). With these indexes, the characteristics of individual representatives (president, dictator) and representative bodies (parliament, coalition, cabinet, council, jurors) are investigated. To bridge the representative and direct democracies, an alternative election method is proposed, which is not based on voting, but on the indexing of the candidates with regard to the political profile of the electorate. In addition, societal applications (federal election, surveys) and non-social applications (multi-criteria decisions, finances, traffic control) are considered.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
PowerPoint

Literature
Tangian, Andranik (2013) Mathematical Theory of Democracy. Springer, Berlin-Heidelberg

Course: Seminar in Mathematics [SemMath]

Coordinators: Fachvertreter der Fakultät für Mathematik
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Will be announced in the respective seminar.
Elective literature:
Will be announced in the seminar.

Course: Analysis tools for combustion diagnostics [2134134]

Coordinators: U. Wagner
Part of the modules: Combustion Engines II (p. 98)[WI4INGMB35]

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

Learning Control / Examinations
The assessment consists of an oral exam (30 min) according to §4 (2), 2 of the examination regulation.

Conditions
The course *Combustion Engines A / Combustion Engines I* has to be completed beforehand.

Recommendations
None.

Learning Outcomes
The students can name and explain state-of-the-art methods to analyse the process in combustion as well as special measuring techniques such as optical and laser analysis. They are able to thermodynamically model, analyse and evaluate the engine process.

Content
energy balance at the engine
energy conversion in the combustion chamber
thermodynamics of the combustion process

flow velocities

flame propagation

special measurement techniques

Workload
regular attendance: 24 hours
self-study: 96 hours

Literature
Lecture notes available in the lectures

Course: Methods in Economic Dynamics [2560240]

Coordinators: I. Ott
Part of the modules: (p. 77)[WI4VWL19]

ECTS Credits	Hours per week	Type	Term	Instruction language
1.5	1/0	lecture	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.

Conditions
None.

Recommendations
Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012] and Economics II [2600014]. Further, it is assumed that students have interest in using quantiative-mathematical methods.

Learning Outcomes
Students shall be given the ability to:

- work with fundamental theoretical innovation models and to implement them in appropriate computer algebra systems
- query appropriate data sources and to analyse and visualise them using statistical methods

Content
The workshop offers the possibility to deepen the understanding about different aspects of theoretical modelling of innovation-based growth and induced economic effects. This includes the implementation of formal models in computer algebra systems as well as recording, processing and econometric analysis of related data from relational databases (concerning for example patents or trademarks). Moreover, methods of network theory are discussed.

Workload
The total workload for this course is approximately 45 hours.
Lecture: 15h
Preparation of lecture/exam: 30h

Media
Slides

Remarks
The course has been added summer 2015.

Course: Microoptics and Lithography [2142884]

Coordinators: T. Mappes
Part of the modules: Microoptics (p. 120)[WI4INGMBIMT3]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	en

Learning Control / Examinations
The assessment will consist of a oral exam (20 min) (following §4 (2), 2 of the examination regulation).

Conditions
The course is compulsory in the module Microoptics and must be examined.

Recommendations
See German version.

Learning Outcomes
See German version.

Content

Workload
Präsenszeit: 21 Stunden
Vor- /Nachbereitung: 42 Stunden
Prüfung und Prüfungsvorbereitung: 27 Stunden

Course: Microactuators [2142881]

Coordinators: M. Kohl
Part of the modules: Microoptics (p. 120)[WI4INGMBIMT3], BioMEMS (p. 116)[WI4INGMBIMT1], Microsystem Technology (p. 122)[WI4INGMBIMT4]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
The assessment will consist of an oral exam (20 min) (following §4 (2), 2 of the examination regulation).

Conditions
None.

Recommendations
It is recommended to attend the lecture “Novel Actuators and Sensors” [2141865].

Learning Outcomes
The student

- knows the basics of the actuation principles
- has the required knowledge on the design, fabrication and operation of microactuators
- is familiar with important microactuators in use and their application areas
- knows typical specifications, advantages and disadvantages of the different microactuators

Content

- Microrobotics: linear actuators, micromotors
- Medical and Life Sciences: Mikrovalves, Micropumps, microfluidic Systems
- Information technology: Optical Switches, mirror systems, read/write heads
- Microelectromechanical systems: Microrelais

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Script of ppt-slides

Literature

1. Technischer Einsatz Neuer Aktoren: Grundlagen, Werkstoffe, Designregeln und Anwendungsbeispiele, D. Jendritza, Expert-Verlag, 3. Auflage, 2008.
2. Microactuators, M. Tabib-Azar, Kluwer Academic Publishers London, 1998.
3. Shape Memory Microactuators, M. Kohl, Springer-Verlag Berlin, 2004.

Course: Microactuators [21881]

Coordinators: M. Kohl
Part of the modules: Sensor Technology I (p. 140)[WI4INGETIT3], Sensor Technology II (p. 141)[WI4INGETIT5]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
The assessment consists of an oral exam (20 min) according to Section 4(2), 2 of the examination regulation.
The examination takes place in every summer semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Recommendations
It is recommended to attend the courses *Material Science II* [21782] and *Electrical Engineering II* [23224] beforehand.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Elective literature:
Microactuators, M. Tabib-Azar, Kluwer Academic Publishers London, 1998.
Mechatronik, B. Heimann, W. Gerth, K. Popp, Carl Hanser Verlag München, 1998.
Technischer Einsatz Neuer Aktoren, D. Jendritza, Expert-Verlag Renningen, 1995.

Course: Microbiology of Food [6635]

Coordinators: Franz
Part of the modules: Specialization in Food Process Engineering (p. 145)[WI4INGCV4]

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

Learning Control / Examinations
See module description.

Conditions
None.

Learning Outcomes

Content

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Course: Mobile Machines [2114073]

Coordinators: M. Geimer
Part of the modules: Mobile Machines (p. 96)[WI4INGMB15]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	4	lecture	Summer term	de

Learning Control / Examinations
See modul description.

Conditions
Knowledge in Fluid Power is required.

Recommendations
It is recommended to attend the course *Fluid Power Systems* [2114093] beforehand.

Learning Outcomes
After completion of the course the students have knowledge of:

- a wide range of mobile machines
- operation modes and working cycles of important mobile machines
- selected subsystems and components

Content

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

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

Media
Lecture notes.

Course: Mobility Services and new Forms of Mobility [6232811]

Coordinators: M. Kagerbauer
Part of the modules: Transportation Modelling and Traffic Management (p. 134)[WI4INGBGU16], Fundamentals of Transportation (p. 133)[WI4INGBGU15]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture + exercise	Summer term	de

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

Conditions
See module description.

Learning Outcomes
See German version.

Content

Workload

Course: Modeling and Analyzing Consumer Behaviour with R [2540470]

Coordinators: V. Dorner, C. Weinhardt
Part of the modules: Service Management (p. 43)[WI4BWLISM6], Service Analytics (p. 59)[WI4BWLKSR1]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise	Summer 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
None.

Learning Outcomes
The students

- learn to use the statistic software R on an advanced level
- understand the approach on how to model and simulate decision support systems
- know methods for evaluating, analyzing, and visualizing data

Content
The students use the R software for handling case studies from the fields of e-commerce and decision support system (DSS). On the implementation level, participants learn to write functions in R to simulate data, e.g., corporate data. On the user level, participants learn methods for analyzing and visualizing data, e.g., for the analysis of product reviews.
Main topics covered by the lecture:
1. Data types and programming concepts in R
2. Data selection and restructuring in data frames
3. Text Mining with R
4. Optimization with R
5. Visualization with R

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Lecture notes

Literature
Field, A., Miles, J., Field, Z., Discovering Statistics Using R, SAGE 2014
Jones, O., Maillardet, R., Robinson, A., Scientific Programming and Simulation Using R, Chapmann & Hall / CRC Press 2009
Venables, W.N., Smith, D.M. and the R Core Team, “An Introduction to R”, 2012 (Version 2.15.2), http://cran.r-project.org/doc/manuals/R-intro.pdf
Wickham, Hadley, ggplot2: Elegant Graphics for Data Analysis (Use R!), Springer 2009 (2nd edition)

Remarks
Limited number of slots
The course has been added summer term 2015.

Course: Model based Application Methods [2134139]

Coordinators: F. Kirschbaum
Part of the modules: Combustion Engines II (p. 98)[WI4INGMB35]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2	lecture + exercise	Summer term	

Learning Control / Examinations
take-home exam, short presentation with oral examination

Conditions
none

Recommendations
knowledge in Basics of combustion engines, vehicular systems, control theorie and statistics.

Learning Outcomes
The student can name the most important methods for model-based calibration of powertrain ECUs. Particulary he can choose and apply the correct approach for empirical modeling for a given powertrain calibration task (fuel consumption, emissions, air path, driveability, etc.) and type of plant (linear-nonlinear, static-dynamic, etc.). He is capable to solve typical Problems of a calibration engineer of automotive OEMs or suppliers.

Content
The efforts for the calibration of automotive powertrain ECUs are increasing due to new engine or powertrain technologies and tightening emission laws. From a present view only model based calibration methods are capable to handle this situation. The lecture presents a selection of practice-proofed model-based calibration methods.

Workload
regular attendance:
Lectures 2 SWS: approx. 22 h
Computer exercises 1 SWS: approx. 11 h
self study: approx. 87 h

Media
Lecture notes, blackboard, presentations and life demonstrations via projector

Course: Modeling Strategic Decision Making [2577908]

Coordinators: H. Lindstädt
Part of the modules: Cross-functional Management Accounting (p. 36)[WI4BWLIBU2], Strategic Corporate Management and Organization (p. 33)[WI4BWLUO1], Strategic Decision Making and Organization (p. 34)[WI4BWLUO4]

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

Learning Control / Examinations
Written exam 100% following §4, Abs. 2.

Conditions
None.

Learning Outcomes
After passing this course students are able to

- discuss individual decisions under multiple goals and subjective expected utility theory.
- handle group decisions.
- assess the implications of asymmetric information and conflicting goals (Agency Theory) on the design of decision tasks
- recognize limits of the basic models and of the expected utility theory.
- illustrate and explain advancements in subjective expected utility theory.

Content
Starting from the basic model of economic decision theory, fundamental decision principles and calculi for multi-attribute decisions in certain and uncertain conditions up to subjective expected utility theory and the economic assessment of information are described. Subsequently participants will become familiar with agency-theoretical approaches and models for the function and design of organizational information and decision-making systems. To confront numerous infringements by decision-makers against principles and axioms of this calculus, in addition non-expected utility calculi and advanced models for decisions by economic agents are discussed; these are especially important for management decisions.

Workload
1 credit represents an estimated workload of 30h. The total workload for this course is approximately 135 hours. For further information see German version.

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.

Course: Business Process Modelling [2511210]

Coordinators: A. Oberweis
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Winter term	de

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

Conditions
None.

Learning Outcomes
Students

- describe goals of business process modeling and aplly different modeling languages,
- choose the appropriate modeling language according to a given context,
- use suitable tools for modeling business processes,
- apply methods for analysing and assessing process modells to evaluate specific quality characteristics of the process model.

Content
The proper modeling of relevant aspects of business processes is essential for an efficient and effective design and implementation of processes. This lecture presents different classes of modeling languages and discusses the respective advantages and disadvantages of using actual application scenarios. For that simulative and analytical methods for process analysis are introduced. In the accompanying exercise the use of process modeling tools is practiced.

Workload
Warning: not a valid latex tabular environment.

Media
Slides, access to internet resources.

Literature
M. Weske: Business Process Management: Concepts, Languages, Architectures. Springer 2012.
F. Schönthaler, G.Vossen, A. Oberweis, T. Karl: Business Processes for Business Communities: Modeling Languages, Methods, Tools. Springer 2012.
Further Literature will be given in the lecture.

Course: Modelling, Measuring and Managing of Extreme Risks [2530355]

Coordinators: U. Werner, S. Hochrainer
Part of the modules: Insurance Management I (p. 31)[WI4BWLFBV6], Insurance Management II (p. 32)[WI4BWLFBV7]

ECTS Credits	Hours per week	Type	Term	Instruction language
2,5	2	lecture	Summer term	de

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Recommendations
None.

Learning Outcomes
See German version.

Content

- Risk preferences under uncertainty, risk management strategies using utility functions, risk aversion, premium calculations, insurance principle, exceptions, Arrow Lind theorem. Probability and statistics introduction, distributions, Lebesgue integration.
- Introduction to Extreme value theory, Catastrophe models: Introduction to extreme value theory, asymptotic models, extremal types theorem, Generalized extreme value distributions, max-stability, domain of attraction inference for the GEV distribution, model generalization: order statistics. Catastrophemodelapproaches, simulationof extremes.
- Threshold models, generalized pareto distribution, threshold selection, parameter estimation, point process characterization, estimation under maximum domain: Pickands's estimator, Hill's estimator, Deckers-Einmahl-de Haan estimator.
- Catastrophe model approaches, simulation of earthquakes, hurricanes, and floods, vulnerability functions, loss estimation. Indirectvsdirecteffects.
- Introduction to financial risk management against rare events. Basic risk measures: VaR, CVar, CEL and current approaches. Risk management measures against extreme risk for different risk bearers: Insurance principle, loading factors, credits, reserve accumulation, risk aversion.
- Risk preferences in decision making processes. Utility theory, certainty equivalent, Arrow Lind proof for risk neutrality, exceptions in risk neutrality assumptions.
- The Fiscal Risk Matrix, Fiscal Hedge Matrix, Dealing with Risk in Fiscal Analysis and Fiscal Management (macroeconomic context, specific fiscal risks, institutional framework). Reducing Government Risk Exposure (Risk mitigation with private sector, Risk transfer and risk-sharing mechanisms, Managing residual risk).
- Approaches to Managing Fiscal Risk (Reporting on financial statements, Cost-based budgeting, Rules for talking fiscal risk, Market-type arrangements). Case: Analyzing Government Fiscal Risk Exposure in China (Krumm/Wong), The Fiscal Risk of Floods: Lessons of Argentina (AlciraKreimer).
- Case study presentations: Household level index based insurance systems (India, Ethiopia, SriLanka, China), insurance back-up systems coupled with public private partnerships (France, US), Reinsurance approaches (Munich Re, Swiss Re, Allianz).
- Climate Change topics: IPCC report, global and climate change.

Workload
The total workload for this course is approximately 75.0 hours. For further information see German version.

Literature

- Woo G (2011) Calculating Catastrophe. Imperial College Press, London, U.K.
- Grossi P and Kunreuther H (eds.) (2005) Catastrophe Modeling: A New Approach to Managing Risk. New York, Springer.
- Embrechts P, Klüppelberg C, Mikosch, T (2003) ModellingExtremal Events for Insurance and Finance. Springer,New York(corr. 4th printing, 1st ed. 1997).
- Wolke, T. (2008). Risikomanagement. Oldenbourg, Muenchen.
- Klugman, A.S, Panjer, H.H, and Willmot, G.E. (2008) Loss Models: From Data to Decisions. 3rd edition. Wiley, New York.
- Slavadori G, Michele CD, Kottegoda NT and Rosso R (2007) Extremes in Nature: An Approach Using Copulas. Springer, New York.

- Amendola et al. (2013) (eds.): *Integrated Catastrophe Risk Modeling. Supporting Policy Processes.* Advances in Natural and Technological Hazards Research, New York, Springer,
- Hochrainer, S. (2006). Macroeconomic Risk Management against Natural Disasters. *German University Press (DUV)*, Wiesbaden, Germany.

Course: Modern Measurement Techniques for Process Optimization [22218]

Coordinators: Regier
Part of the modules: Specialization in Food Process Engineering (p. 145)[WI4INGCV4]

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

Learning Control / Examinations
See module description.

Conditions
None.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Course: Morphodynamics [6222805]

Coordinators: F. Nestmann
Part of the modules: Understanding and Prediction of Disasters 1 (p. 148)[WI4INGINTER7], Understanding and Prediction of Disasters 2 (p. 149)[WI4INGINTER8]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	1/1	lecture + exercise	Summer term	

Learning Control / Examinations
See German version.

Conditions
None.

Recommendations
None.

Learning Outcomes

Content
See German version.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Engine measurement techniques [2134137]

Coordinators: S. Bernhardt
Part of the modules: Combustion Engines II (p. 98)[WI4INGMB35]

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

Learning Control / Examinations
The assessment consists of an oral exam (30 min) according to Section 4 (2), 2 of the examination regulation.

Conditions
The course *Combustion Engines A /* Combustion Engines I has to be completed beforehand.

Recommendations
None.

Learning Outcomes
The students are able to explain the principles of modern measuring devices and are able to determin the right device for a certain measuring problem. The are able to analyse and evaluate the results.

Content
Students get to know state-of-the-art measurement techniques for combustion engines. In particular basic techniques for measuring engine operating parameters such as torque, speed, power and temperature.

Possible measurement errors and abberations are discussed.

Furthermore techniques for measuring exhaust emissions, air/fuel ratio, fuel consumption as well as pressure indication for thermodynamic analysis are covered.

Workload
regular attendance: 21 hours
self-study: 100 hours

Literature
Lecture notes available in the lectures or in the 'Studentenhaus'

1. Grohe, H.:Messen an Verbrennungsmotoren
2. Bosch: Handbuch Kraftfahrzeugtechnik
3. Veröffentlichungen von Firmen aus der Meßtechnik
4. Hoffmann, Handbuch der Meßtechnik
5. Klingenberg, Automobil-Meßtechnik, Band C

Course: Multivariate Statistical Methods [2520317]

Coordinators: O. Grothe
Part of the modules: Econometrics and Statistics II (p. 92)[WI4STAT6], Statistical Methods in Risk Management (p. 89)[WI4STAT2], Analytics and Statistics (p. 90)[WI4STAT4]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/2	lecture + exercise	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. The exam is offered every semester. Re-examinations are offered only for repeaters.

Conditions
None.

Recommendations
It is strongly recommended to attend the courses *Statistics 1*, *Statistics 2* and *Analysis of multivariate Data*.

Learning Outcomes
Students

- choose appropriate methods for the illustration of multivariate data, for structure analysis as well as dimension reduction, and apply these.
- apply regression models.
- apply software.

Content

- Graphical methods for multivariate Data
- Regression Analysis (incl. logistic regression)
- Principal Component, Factor and Correspondence Analysis
- Multidimensional Scaling
- Hierarchical Classification

Workload
The total workload for this course is approximately 135 hours.
Lecture: 30 hours
Preparation of lecture: 75 hours
Exam preparation: 30 hours

Remarks
The credits for the course “Multivariate Statistical Methods” have been changed from 5 to 4,5 from winter term 2015/2016 on.

Course: Nanotechnology with Clusterbeams [2143876]

Coordinators: J. Gspann
Part of the modules: Nanotechnology (p. 124)[WI4INGMBIMT5], Microsystem Technology (p. 122)[WI4INGMBIMT4]

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

Learning Control / Examinations
The assessment will consist of a oral exam (30 min) (following §4 (2), 2 of the examination regulation).

Conditions
None.

Recommendations
None.

Learning Outcomes
Nanotechnology is presented on the basis of a technology for nano- and microstructuring by accelerated nanoparticles (clusters), mainly in view of nanomechanics.

Content
Nanotechnology in biology
Nanosystemstechnology
Cluster beam generation, ionisation and acceleration; cluster properties
Structure generation using accelerated metal clusters
Structuring via gas cluster impact; reactive accelerated cluster erosion (RACE)
Atomic force microscopy of impact structures; nanotribology
Comparison with femtosecond laser machining (Winter term only)
Simulations; Fullerene synthesis, impact structures, visionary nanomachinery

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Foil copies with short commentaries are distributed during the lectures.

Course: Nanotechnologie using Scanning Probe Methods [2142860]

Coordinators: H. Hölscher, M. Dienwiebel, S. Walheim
Part of the modules: Nanotechnology (p. 124)[WI4INGMBIMT5]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
The assessment will consist of a oral exam (30 min) (following §4 (2), 2 of the examination regulation).

Conditions
The course is compulsory in the module Nanotechnology and must be examined.

Recommendations
Knowledge in physics, mathematics and chemistry.

Learning Outcomes
The students has fundamental knowledge in nanotechnology and scanning probe methods.

Content
1) Introduction into nanotechnology
2) History of scanning probe methods
3) Scanning tunneling microscopy (STM)
4) Atomic force microscopy (AFM)
5) Dynamic Modes (DFM, ncAFM, MFM, KPFM, . . .)
6) Friction force microscopy and nanotribology
7) Nanolithography & block copolymeres

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Slides of the lectures

Course: Nanotribology and -Mechanics [2181712]

Coordinators: M. Dienwiebel, H. Hölscher
Part of the modules: Microfabrication (p. 118)[WI4INGMBIMT2], Nanotechnology (p. 124)[WI4INGMBIMT5]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture		

Learning Control / Examinations
See German version.

Conditions
None.

Recommendations
Knowledge in mechanics and physics.

Learning Outcomes
The student can

- explain the physical foundations and common models used in the field of nanotribology and nanomechanics
- describe the most important experimental methods in nanotribology
- critically evauate scientific papers on nanotribological issues with respect to their substantial quality

Content
Part 1: Basics:

- Nanotechnology
- Forces at nanometer scale
- contact mechanics models (Hertz, JKR, DMT)
- Experimental methods (SFA, QCM, FFM)
- Prandtl-Tomlinson model
- Superlubricity
- Atomic-Scale Wear

Part 2: Topical papers

Workload
See German version.

Literature
Lecture notes, slides and copies of articles

Course: Nature-inspired Optimisation Methods [2511106]

Coordinators: P. Shukla
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Summer term	en

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

Conditions
None.

Learning Outcomes
To learn:

1. Different nature-inspired methods: local search, simulated annealing, tabu search, evolutionary algorithms, ant colony optimization, particle swarm optimization
2. Different aspects and limitation of the methods
3. Applications of such methods
4. Multi-objective optimization methods
5. Constraint handling methods
6. Different aspects in parallelization and computing platforms

Content
Many optimization problems are too complex to be solved to optimality. A promising alternative is to use stochastic heuristics, based on some fundamental principles observed in nature. Examples include evolutionary algorithms, ant algorithms, or simulated annealing. These methods are widely applicable and have proven very powerful in practice. During the course, such optimization methods based on natural principles are presented, analyzed and compared. Since the algorithms are usually quite computational intensive, possibilities for parallelization are also investigated.

Workload
Workload: 120h insgesamt, 8h pro Woche

davon 22h 30min Vorlesung (15 x 2 x 45min)
11h 15min Übung (15 x 1 x 45min)
24h Übungsblätter vorbereiten (8 x 3h)
24h Skript wiederholen (2 x 12h)
6h 15min Fünf Klausuren rechnen (5 x 1h 15min)
32h Prüfungsvorbereitung
Der Gesamtarbeitsaufwand für diese Lerneinheit beträgt ca. 150 Stunden (5.0 Credits).
\begin{tabular}{lcr}
Aktivität && h \\
\hline
\itshape Präsenzzeit && \\
Vorlesung/\"Ubung & (16 x 2 x 45 min) & 24 h \\
\hline
Online-Module bearbeiten & (10 x 60 min) & 10 h\\
Vorlesung/Übung nacharbeiten & (16 x 1 h) & 16 h\\
Übungsblätter bearbeiten, Protokoll schreiben etc. & & 28 h \\
Skript 2x wiederholen & (2 x 16h) & 32h \\
Prüfungsvorbereitung && 40 h \\
\hline
Summe: && 150h\\
\end{tabular}

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: Scientific Bases for Examination and Assessement of Water Quality [22603]

Coordinators: G. Abbt-Braun
Part of the modules: Water Chemistry and Water Technology II (p. 147)[WI4INGCV7]

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

Learning Control / Examinations
See module description.

Conditions
None.

Learning Outcomes
The lecture gives basics on analytical examination methods which are used to assess water constituents.

Content
1. Hydrological cycle, application, problems, ground-, surface-, wastewater, analytical definitions
2. Sampling, quick tests, conservation, on site examinations, organoleptic
3. General examinations
4. Optical characterization
5. Titrations
6. Main constituents, anions
7. Main constituents, cations
8. Metals
9. Organics
10. Polar organic substances, derivatisation
11. Water specific sum parameters
12. Radioactivity
13. Microbiology

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Literature
Elective literature:

- Cammann, K. Instrumentelle Analytische Chemie. Verfahren, Anwendungen, Qualitätssicherung. Spektrum Verlag, 2001.
- Frimmel, F. H.: Wasser und Gewässer. Ein Handbuch. Spektrum Verlag, 1999.
- Grohmann, A., Hässelbarth, U., Schwerdtfeger, W.(Hrsg.): Die Trinkwasserverordnung. 4. Auflage, E. Schmid, Berlin, 2002.
- Kölle, W.: Wasseranalysen-richtig beurteilt. Grundlagen, Parameter, Wassertypen, Inhaltsstoffe, Grenzwerte nach Trinkwasserverordnung und EU-Trinkwasserrichtlinie. 2. Auflage, Wiley-VCH Verlag, 2004.
- Quentin, K.-E.: Trinkwasser; Untersuchung und Beurteilung von Trink- und Schwimmbadwasser. Springer, Heidelberg, 1988.

Course: Novel Actuators and Sensors [2141865]

Coordinators: M. Kohl, M. Sommer
Part of the modules: Optoelectronics and Optical Communication (p. 125)[WI4INGMBIMT6], Microsystem Technology (p. 122)[WI4INGMBIMT4], Nanotechnology (p. 124)[WI4INGMBIMT5]

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

Learning Control / Examinations
The assessment will consist of a oral exam (20 min) (following §4 (2), 2 of the examination regulation).

Conditions
None.

Learning Outcomes
The student

- knows physical principles and basics on novel actuators and sensors
- has the required knowledge on the design, fabrication and operation of novel actuators and sensors
- is familiar with important novel actuators and sensors in use
- can name typical fields of application
- knows typical specifications

Content
Topics of the first part:

- Piezo actuators
- Magnetostrictive actuators
- Shape memory actuators
- Electrorheological actuators

Topics of the second part:

- Nano sensors: materials, fabrication
- Nano fibres
- Examples: gas sensors, electronic nose
- Data processing /interpretation

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Script / script of ppt foils (part 2)

Course: Non- and Semiparametrics [2521300]

Coordinators: M. Schienle
Part of the modules: Econometrics and Statistics II (p. 92)[WI4STAT6], Econometrics and Statistics I (p. 91)[WI4STAT5]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/2	lecture + exercise	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam (90 minutes) (following §4(2), 1 of the examination regulation).

Conditions
None.

Recommendations
Knowledge of the contents covered by the course *"Applied Econometrics"* [2520020]

Learning Outcomes
The student

- shows comprehensive knowledge of non- and semiparametric estimation techniques
- is able to apply his/her technical knowledge using software in order to critically assess empirical problems

Content
Kernel density estimator, local constant and local polynomial regression, choice of bandwidth, Series- and Sieve-Estimators, additive models, semiparametric models

Workload
The total workload for this course is approximately 135 hours (4.5 credits).
regular attendance: 30 hours
self-study: 65 hours
exam preparation: 40 hours

Media
Slides

Literature
Li, Racine: Nonparametric Estimation

Course: Nonlinear Optimization I [2550111]

Coordinators: O. Stein
Part of the modules: Mathematical Programming (p. 86)[WI4OR6]

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

Learning Control / Examinations
The assessment consits of a written exam (60 minutes) according to Section 4(2), 1 of the examination regulation and possibly of a compulsory prerequisite.
The exam takes place in the semester of the lecture and in the following semester.
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
The successful completion of a compulsory prerequisite is mandatory for admission to the exam.

Learning Outcomes
The student

- knows and understands fundamentals of unconstrained nonlinear optimization,
- is able to choose, design and apply modern techniques of unconstrained nonlinear optimization in practice.

Content
The lecture treats the minimization of smooth nonlinear functions under nonlinear constraints. For such problems, which occur very often in economics, engineering, and natural sciences, we derive optimality conditions that form the basis for numerical solution methods. The lecture is structured as follows:

- Introduction, examples, and terminology
- Existence results for optimal points
- First and second order optimality condtions for unconstrained problems
- Optimality conditions for unconstrained convex problems
- Numerical methods for unconstrained problems (line search, steepest descent method, variable metric methods, Newton method, Quasi Newton methods, CG method, trust region method)

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Lecture notes.

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: Mathematical Programming (p. 86)[WI4OR6]

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

Learning Control / Examinations
The assessment consits of a written exam (60 minutes) according to Section 4(2), 1 of the examination regulation and possibly of a compulsory prerequisite.
The exam takes place in the semester of the lecture and in the following semester.
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
The successful completion of a compulsory prerequisite is mandatory for admission to the exam.

Learning Outcomes
The student

- knows and understands fundamentals of constrained nonlinear optimization,
- is able to choose, design and apply modern techniques of constrained nonlinear optimization in practice.

Content
The lecture treats the minimization of smooth nonlinear functions under nonlinear constraints. For such problems, which occur very often in economics, engineering, and natural sciences, we derive optimality conditions that form the basis for numerical solution methods. Part I of the lecture treats unconstrained optimization problems. Part II of the lecture is structured as follows:

- Topology and first order approximations of the feasible set
- Theorems of the alternative, first and second order optimality conditions for constrained problems
- Optimality conditions for constrained convex problems
- Numerical methods for constrained problems (penalty method, multiplier method, barrier method, interior point method, SQP method, quadratic optimization)

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Lecture notes.

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: Public Revenues [2560120]

Coordinators: B. Wigger, Assistenten
Part of the modules: Advanced Topics in Public Finance (p. 76)[WI4VWL18]

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

Learning Control / Examinations
The assessment consists of an 1h written exam following Art. 4, para. 2, clause 1 of the examination regulation. The grade for this course equals the grade of the written exam.

Conditions
Basic knowledge of Public Finance is required.

Learning Outcomes
See German version.

Content
The *Public Revenues* lecture is concerned with the theory and policy of taxation and public dept. In the first chapter, fundamental concepts of taxation theory are introduced, whereas the second chapter deals with key elements of the German taxation system. The allocative and distributive effects of different taxation types are examined in chapter three and four. Chapter five integrates both allocative and distributive components in order to derive a theory of optimal taxation. The core of the sixth chapter is represented by international aspects of taxation. The debt part begins with a description of the extent and structure of public dept in chapter seven. In the following chapter, macroeconomic theories of national dept are evolved, while chapter nine is concerned with its long term consequences when employed as a regular instrument of budgeting. Finally, the tenth chapter deals with constitutional limits to public debt-incurring.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Elective literature:

- Homburg, S.(2000): *Allgemeine Steuerlehre,* Vahlen
- Rosen, H.S.(1995): *Public Finance*; 4th ed., Irwin
- Wellisch, D.(2000): *Finanzwissenschaft I* and *Finanzwissenschaft III*, Vahlen
- Wigger, B. U.(2006): *Grundzüge der Finanzwissenschaft*; 2nd ed., Springer

Course: Public Media Law [24082]

Coordinators: C. Kirchberg
Part of the modules: Public Business Law (p. 154)[WI4JURA6]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
As the traditional media (print, radio, TV) the "new media" (online-services and the Internet) is governed by public law, yet with a different extent of regulation and with apparent effects on private law. The main influences for the media law are constitutional law and European community law. The lectures aims at providing an overview of the common grounds and differences of the current media law regime and of the conceivable perspectives of media convergence. Current developments in politics and economics, which are relevant for public media law, will be used as examples in the lecture. Besides, it is planned to attend a court hearing of the Federal Constitutional Court (Bundesverfassungsgericht) and/or the Federal Court (Bundesgerichtshof).

Content
Initially, the lecture will deal with the constitutional basis of the media law regime. i.e. the responsibilities of the Federal and the State legislatures, freedom of speech, freedom of information, constitutional media rights (Art. 5 para. 1 Constitutional Law) and its limitations by general laws, the ban on censorship and the counterstatement law. In addition, the European community principles on broadcasting and media law will be part of the lecture. Next will be an overview of the individual media laws, namely the broadcasting law (especially Rundfunkstaatsvertrag) the press law of the States and the statute on the so-called "telemedia" services. Finally, the protection of minors in the media will be dealt with (Act on Protection of Minors and Treaty on the Protection of Minors in the Media).

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
To understand the legal framework it is necessary for the students to have the relevant statutes, for example "Telemediarecht, Telekommunikations- und Multimediarecht", beck-Texte im dtv , 7. Auflage 2007.
As an introduction it is recommended to read: Frank Fechner, Medienrecht, Verlag Mohr Siebeck, Verlag Mohr Siebeck, 8. Auflage 2007.

Course: Life Cycle Assessment [n.n.]

Coordinators: H. Keller
Part of the modules: Industrial Production II (p. 45)[WI4BWLIIP2]

ECTS Credits	Hours per week	Type	Term	Instruction language
3,5	2	lecture	Winter term	de

Learning Control / Examinations
The assessment consists of an oral exam (30 min.) or a written exam (60 min.).

Conditions
None.

Recommendations
None.

Learning Outcomes
Students

- understand why it is essential for the future viability of companies and other stakeholders in society to assess products and services based on their whole life cycles.
- have knowledge in basics and methodology of life cycle assessment.
- apply life cycle assessment in basic decision contexts.
- are aware of contexts that require further in-depth knowledge in sustainability assessment.

Content
Our society has reached a historically unique material prosperity. At the same time, environmental burdens and resource consumption are continuously reaching new peaks - not only regarding greenhouse gas emissions and oil production rates. It is obvious that the material and energy intensity of products and services has to decrease if we want to keep our current level of material prosperity on the long run. Enormous efficiency gains, as they have been reached e.g. for labour productivity, however, require that environmental burdens and resource consumption per unit of product are in the first place known, transparent and can thus be optimised. This data and its calculation are increasingly requested and sooner or later will have to become as essential for management as e.g. unit labour costs.
Life cycle assessment is a methodology in sustainability assessment that provides this information and deduces optimisation potentials and decision support for companies, politics, consumers etc. To this end, material and energy flows are compiled along the whole life cycle of a product from extraction of raw materials, via production and use of a product until its disposal. Subsequently, environmental impacts of these flows are analysed.
This lecture describes structure and individual steps of life cycle assessments in detail. Furthermore, it explains its application in decision support. In interactive phases, participants recapitulate the theoretical basis by own calculations. As an outlook, further instruments in sustainability assessment are introduced that analyse other sustainability aspects.

Workload
The total workload for this course is approximately 105 hours. For further information see German version.

Remarks
The course will be offered from winter term 2015/16 and replace the course “Material Flow Analysis and Life Cycle Assessment [2581995]”.

Course: Marketing Communication [2572200]

Coordinators: J. Kim
Part of the modules: Services Marketing (p. 56)[WI4BWLMAR9]

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

Learning Control / Examinations
The assessment consists of a written exam (60 min) (according to §4(2), 1 of the examination regulation)

Conditions
None.

Learning Outcomes
Students

- know about current topics (research and practice) in online marketing and learn how the transparency of the internet provides new opportunities to measure the success of marketing instruments
- learn about relevant marketing metrics
- know how to differentiate terms like SEO, SEM, social media, content marketing and gamification.
- are able to implement their marketing knowledge in a practical context

Content
The aim of this lecture is to provide an overview of research on online marketing tools. Students learn about current topics (research and practice) in online marketing and learn how the transparency of the internet provides new opportunities to measure the success of marketing instruments.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Lecture slides will be provided in ILIAS

Literature
Stokes, Rob (2012), “eMarketing: The Essential Guide to Online Marketing,” available here:http://students.flatworldknowledge.com/course?ci
See lecture slides for further recommendations on literature

Remarks
new course starting winter term 2015/2016

Course: Open Innovation – Concepts, Methods and Best Practices [2571199]

Coordinators: A. Hahn
Part of the modules: Marketing Management (p. 51)[WI4BWLMAR5]

ECTS Credits	Hours per week	Type	Term	Instruction language
1,5	1/0	lecture	Summer term	en

Learning Control / Examinations
Non exam assessment (presentation) (following §4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
Students

- know approaches, objectives, advantages and disadvantages of Open Innovation,
- know strategy, processes, methods and fields of application of Open Innovation,
- understand success factors by means of best practices from real life projects,
- can apply Open Innovation methods on their own.

Content
Joy's Law: "No matter who you are, most of the smartest people work for someone else" (Bill Joy, Co-Founder Sun Microsystems)
This lecture conveys an understanding and practical application of Open Innovation, i.e. the collaborative opening of the innovation process to customers, suppliers, partners, competitors, new markets. . . . The contents encompass among others:

- approaches, objectives, advantages and disadvantages of Open Innovation
- knowledge of approaches, objectives, advantages and disadvantages of Open Innovation
- strategy, processes, methods and fields of application of Open Innovation
- focus mainly on customer integration into the innovation process (e.g. Netnography, Crowdsourcing, Lead User, Trend Receiver,. . .)
- Understanding of success factors by means of best practices from real life projects (Digital Open Innovation, Idea Contests, Ideation, Hackathons, Idea Management, Customer Engagement, Lead User, Trend Receiver,. . .)
- Independent application of Open Innovation methods.

Workload

Literature
To be announced in the course.

Remarks
For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).
Please note that only one of the following courses can be chosen in the Marketing Management Module: Marketing Strategy Business Game, Strategic Brand Management, Open Innovation – Concepts, Methods and Best Practices or Business Plan Workshop.
Exception: In summer term 2016 exceptionally two courses can be chosen or, in case one course has already been chosen previously, a second course can be chosen.
Please note: The number of participants for this course is limited. The Marketing & Sales Research Group typically provides the possibility to attend a course with 1,5 ECTS in the respective module to all students. Participation in a specific course cannot be guaranteed.

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. 84)[WI4OR5]

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

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

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

Learning Outcomes
The student

- knows applications of basic and advanced methods of Operations Research applied to health services,
- gains the ability to use quantitative models for the operations planning and logistics in a hospital environment, e.g. appointment, transportation, operating room planning or nurse rostering as well as inventory management and layout planning
- describes the advantages and benefits of simulation models and OR methods to plan home health care services,
- applies the introduced methods in detail in practical case studies.

Content
In the last years reforms of the German health system, e.g. the introduction of the G-DRG-system, have put an increasing cost pressure on hospitals. Therefore their target is to improve quality, transparency, and efficiency of hospital services, e.g. by reducing the length of stay of patients. To achieve this, processes have to be analyzed in order to optimize them if necessary. When looking at the targets of optimization not only efficiency but also quality of care and patient satisfaction (e.g. waiting times) have to be taken into account.
Besides hospitals also home health care services and their planning are discussed in this lecture. Because of the demographic development this is an emerging field in the health care sector. Here, e.g. nurse rosters have to be built which give details about which nurse visits which patient at what time. While doing so different targets have to be regarded, e.g. the continuity of nurse-patient relationship or the minimization of the distances the nurses have to travel.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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 2016. The planned lectures and courses for the next three years are announced online.

Course: Operations Research in Supply Chain Management [2550480]

Coordinators: S. Nickel
Part of the modules: Operations Research in Supply Chain Management and Health Care Management (p. 84)[WI4OR5]

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

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

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

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

Learning Outcomes
The student

- knows and applies basic and advanced modeling techniques playing an important role in today's problem solving occurring in supply networks
- models problems with a mathematical approach to technical-economical problems, and derives optimal solutions,
- classifies problems both conceptually and mathematically by identifying central variables and parameters in a specific problem setting,
- evaluates current developments in operations research and supply chain management.

Content
Supply Chain Management constitutes a general tool for logistics process planning in supply networks. To an increasing degree quantitative decision support is provided by methods and models from Operations Research. The lecture "OR in Supply Chain Management" conveys concepts and approaches for solving practical problems and presents an insight to current research topics. The lecture's focus is set on modeling and solution methods for applications originating in different domains of a supply chain. The emphasis is put on mathematical methods like mixed integer programming, valid inequalities or column generation, and the derivation of optimal solution strategies.
In form and content, the lecture addresses all levels of Supply Chain Management: After a short introduction, the tactical and operational level will be discussed with regard to inventory models, scheduling as well as cutting and packing. The strategic level will be discussed in terms of layout planning. Another main focus of the lecture is the application of methods from online optimization. This optimization discipline has gained more and more importance in the optimization of supply chains over the several past years due to an increasing amount of dynamic data flows.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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 2016/17. The planned lectures and courses for the next three years are announced online.

Course: Optical Communication Systems [23460 / 23461]

Coordinators: J. Leuthold, W. Freude
Part of the modules: Optoelectronics and Optical Communication (p. 125)[WI4INGMBIMT6]

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

Learning Control / Examinations
The assessment will consist of a oral exam (20 min) (following §4 (2), 2 of the examination regulation).

Conditions
The course is compulsory in the module Optoelectronics and Optical Communication and must be examined.

Recommendations
Mathematics of a bachelor.

Learning Outcomes
The students will:

- Know how a transmitter works
- Know the key modulation formats in optical communications
- Know the receivers, their limitations

Content
- Communications fundamentals
- Modulation Formats:
o The transmitter
o Digital modulation formats
o Optical Modulators
o Discussion of selected modulation formats
o Comparision of formats
o Electronic Coding Techniques
o OSNR and Transmission distance
- Multiplexing Techniqes
o Orthogonality
o WDM/FDM
o TDM
o OFDM
o CDMA
- Optical Amplifiers
- pin Photodiodes
- Noise
Receivers and detection errors

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Viewegraph & blackboard lecture
Lecture notes will be handed out.

Course: Optical Sources and Detectors [23462/23463]

Coordinators: C. Koos
Part of the modules: Optoelectronics and Optical Communication (p. 125)[WI4INGMBIMT6], Microoptics (p. 120)[WI4INGMBIMT3]

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

Learning Control / Examinations
The assessment will consist of a oral exam (20 min) (following §4 (2), 2 of the examination regulation).

Conditions
This lecture can not be combined with lecture Optoelectronic Components [23486 / 23487].

Recommendations
Basic knowledge of semiconductor physics and electrodynamics is recommended.

Learning Outcomes
The student understands basic principles of optoelectronic components and can mathematically describe their dynamic behaviour. He/she has an overview on source and detector technologies that are used in state-of-the-art optical communication systems.

Content

- Optical processes in semiconductors
- Light-emitting diodes
- Lasers and optical amplifiers
- Pin-photodiodes
- Avalanche photodiodes
- Optical receivers and noise

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Lecture notes, lecture slides, problem sets

Literature
Will be announced in the lecture.

Course: Optical Waveguides and Fibers [23464/23465]

Coordinators: C. Koos
Part of the modules: Optoelectronics and Optical Communication (p. 125)[WI4INGMBIMT6], Microoptics (p. 120)[WI4INGMBIMT3]

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

Learning Control / Examinations

Conditions
This lecture can not be combined with lecture Optoelectronic Components [23486 / 23487].

Recommendations
Basic knowledge of electrodynamics is recommended.

Learning Outcomes
The student understands basic principles of optical waveguiding and can mathematically describe wave propagation in waveguides. He/she has an overview on today's fiber and waveguide technologies.

Content

- Optical communications - an overview
- Fundamentals of wave propagation
- Slab waveguides
- Optical fibers
- Integrated optical waveguides
- Planar lightwave circuits

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Lecture notes, lecture slides, problem sets

Literature
Will be announced in the lecture.

Course: Optimization in a Random Environment [25687]

Coordinators: K. Waldmann
Part of the modules: Stochastic Modelling and Optimization (p. 87)[WI4OR7]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1/2	lecture + exercise + tutorial	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following Section 4(2), 1 of the examination regulation. Credit from the voluntary computer lab is accounted for in the overall grade raising the exam grade by a 2/3 step of a full grade (according to Section 4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
Students are enabled to apply their knowledge about techniques and methodology on current problems such as the measurement and evaluation of operational risk as required by the Basel II accord. Subject matter of the course will be announced in due time.

Content
The course is concerned with the quantitative analysis of selected problems arising in engineering and natural sciences. Subject matter of the course will be announced in due time.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Blackboard, slides, flash-animations, java tools, 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: Optoelectronic Components [23486 / 23487]

Coordinators: W. Freude
Part of the modules: Microsystem Technology (p. 122)[WI4INGMBIMT4]

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

Learning Control / Examinations
The assessment will consist of a oral exam (20 min) according to §4 (2), 1 of the examination regulation.

Conditions
This course can not be combined with the course Optical Sources and Detectors [23462 / 23463] and/or Optical Waveguides and Fibers [23464 / 23465.

Recommendations
Recommendations for lectures (but this is not mandatory for this course): "Electrodynamics and field calculations" or similar course on electrodynamics, "Semiconductor Devices" or similar course, "High-frequency Technology".
Minimal background required: Calculus, differential equations, Fourier transforms and p-n junction physics.

Learning Outcomes
The students understand the components of the physical layer of optical communication systems. To this end, the students

- acquire the knowledge of operation principles and impairments of optical waveguides,
- know the basics of laser diodes, luminescence diodes and semiconductor optical amplifiers,
- understand pin-photodiodes, and
- know the systems' sensitivity limits, which are caused by optical and electrical noise.

The knowledge presented is important in comprehending the physical layer of optical communication systems. It is this very basic understanding which enables a designer to read a device's data sheet, to make most of its favourite properties, and to avoid hitting its limitations.
Learning the working principles of key components in optical communications opens the road to understand design and performance aspects of modern transmission systems. The following components are discussed>

- Light waveguides: Wave propagation, slab waveguides, strip wave-guides, integrated optical waveguides, fibre waveguides
- Light sources and amplifiers: Luminescence and laser radiation, luminescent diodes, laser diodes, stationary and dynamic behavior, semiconductor optical amplifiers
- Receivers: pin photodiodes, electronic amplifiers, noise

Content
The course concentrates on the most basic optical communication components. Emphasis is on physical understanding, exploiting results from electromagnetic field theory, (light waveguides), solid-state physics (laser diodes, LED, and photodiodes), and communication theory (receivers, noise).

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Detailed textbook-style lecture notes, and lecture slides

Literature

- Grau, G.; Freude, W.: Optische Nachrichtentechnik, 3. Ed. Berlin: Springer-Verlag 1991. In German. Since 1997 out of print.
  Corrected reprint Karlsruhe 2005, available via W. F. (w.freude@kit.edu).
- Voges, E.; Petermann, K. (Eds.): Optischen Kommunikationstechnik Handbuch für Wissenschaft und Industrie. Springer-Verlag, Berlin 2002. In German
- Agrawal, G. P.: Lightwave technology. Hoboken: John Wiley & Sons 2004
- Iizuka, K.: Elements of photonics. Vol. I, especially Vol. II. Hoboken: John Wiley & Sons 2002

Course: OR-oriented modeling and analysis of real problems (project) [25688]

Coordinators: K. Waldmann
Part of the modules: Stochastic Modelling and Optimization (p. 87)[WI4OR7]

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

Learning Control / Examinations
Presentation and documentation of the rssults.

Conditions
None.

Learning Outcomes
Students are enabled to apply their knowledge about techniques and methodology on real problems and to develop a practically oriented solution an an OR-lab; e.g. in the public health sector. Subject matter of the course will be announced in due time.

Content
The course is concerned with the quantitative analysis of selected problems arising in engineering and natural sciences. Subject matter of the course will be announced in due time.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Blackboard, slides, flash-animations, java tools, 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: Organic Computing [2511104]

Coordinators: H. Schmeck
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Electives in Informatics (p. 82)[WI4INFO3], Informatics (p. 78)[WI4INFO1]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	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 include 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. The course addresses major concepts and methods of Organic Computing and highlights the impact and potential of Organic Computing with respect to real-world applications, specifically in traffic and energy scenarios.

Workload
The total workload for this course is approximately 150.0 hours. For further information see German version.

Media
powerpoint slides with annotations, 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.
- Organic Computing - A Paradigm Shift for Complex Systems. C. Müller-Schloer, H. Schmeck, T. Ungerer (eds): Springer, Autonomic Systems, Basel, 627 p., 2011

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. 33)[WI4BWLUO1]

ECTS Credits	Hours per week	Type	Term	Instruction language
3.5	2/0	lecture	Winter term	de

Learning Control / Examinations
The assessment will consist of a written exam (60 min) taking place at the beginning of the recess period (according to Section 4 (2), 2 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Learning Outcomes
After passing this course students are able to

- evaluate strengths and weaknesses of existing organisational structures and rules.
- compare alternatives of organisational structure in practice and assess and interpret them regarding their effectiveness and efficiency.
- assess the management of organisational changes.

Content
The course should enable the participants to assess the strengths and weaknesses of existing organisational structures and rules using systematic criteria. Here concepts and models for designing organisation structures, regulating organizational processes and managing organisational changes are presented and discussed using case studies. The course is structured to relate to actions and aims to give students a realistic view of the opportunities and limits of rational design approaches.

Workload
The total workload for this course is approximately 105.0 hours. For further information see German version.

Media
Slides.

Literature

- Laux, H.; Liermann, F.: *Grundlagen der Organisation*, Springer. 6. Aufl. Berlin 2005.
- Lindstädt, H.: *Organisation*, in Scholz, C. (Hrsg.): Vahlens Großes Personallexikon, Verlag Franz Vahlen. 1. Aufl. München, 2009.
- Schreyögg, G.: *Organisation. Grundlagen moderner Organisationsgestaltung*, Gabler. 4. Aufl. Wiesbaden 2003.

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

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

Course: Organization Theory [2577904]

Coordinators: H. Lindstädt
Part of the modules: Strategic Corporate Management and Organization (p. 33)[WI4BWLUO1], Strategic Decision Making and Organization (p. 34)[WI4BWLUO4]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2	lecture	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam following §4, Abs. 2, 1 of the examination regulation.

Conditions
None.

Learning Outcomes
The participants are made familiar with mostly classical principles of economic organisational theory and institutional economics. This includes transaction cost theory and agency-theory approaches, models for the function and design of organisational information and decision-making systems, transfer price models to coordinate the exchange of goals and services within companies. The course therefore lays the basis for a deeper understanding of the advanced literature on this key economic area.

Content
Concretely, after passing this course the students should be able to assess effects and implications of the following aspects:

- Design of transactional relationships between different steps of the value-adding process
- Design of decision tasks under diverse aspects
- Organisation under asymmetric information and conflicting goals (agency theory)

Workload
1 credit represents an estimated workload of 30h. The total workload for this course is approximately 135 hours. For further information see German version.

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.

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

Course: Oxidation and Desinfection Processes [22612]

Coordinators: H. Horn
Part of the modules: Water Chemistry and Water Technology II (p. 147)[WI4INGCV7]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2/0	lecture	Summer term	de

Learning Control / Examinations
See module description.

Conditions
None.

Learning Outcomes
The student

- has knowledge about the main treatment steps in oxidation and disinfection,
- knows about the different types of oxidations processes.

Content
Part I: Theoretical basics of the main methods:
1. Disinfection with chlorine (Cl_2,/HOCl, ClO_2), UV-irradiation, silver (Ag^+), ozone (O_3)
2. Oxidation with Ozone O_3, potassium permanganate $KMnO_4$, hydrogen peroxide H_2O_2, combined oxidation methods UV/H_2O_2, UV/O_3, H_2O_2/O_3, oxygen O2
3. Detection reactions of oxidants (O_3, H_2O_2, Cl_2)
4. Water constituents and their interaction in the treatment steps: THM- and AOX-formation, AOC
5. Special problems: CKW, nitrate, Br^-/BrO_3^-
Part II: Introduction of selected treatment plants: Functional principles (schematic), discussion of the methods applied with advantages and disadvantages

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Literature
Elective literature:

- Crittenden, J. [Ed.]: Water Treatment. Principles and Design. 2nd ed. Wiley & Sons, 2005.
- DVGW: Wasseraufbereitung - Grundlagen und Verfahren. In: Lehr- und Handbuch Wasserversorgung Bd.6. Oldenbourg Industrieverlag, 2004.
- Frimmel, F. H.: Wasser und Gewässer. Ein Handbuch. Spektrum Verlag, 1999.
- Grombach, P., Haberer, K., Merkl, G., Trüeb, E. U.: Handbuch der Wasserversorgungstechnik. 3. Auflage, R. Oldenbourg-Verlag, München, 2000.
- Hancke, K.: Wasseraufbereitung, Chemie und chemische Verfahrenstechnik. 5. Auflage, Springer, Heidelberg, 2000.

Remarks
The course will not be offered any more from summer term 2015 on. The examination will be offered latest until summer term 2017 (repeaters only).

Course: P&C Insurance Simulation Game [INSGAME]

Coordinators: U. Werner
Part of the modules: Insurance Management II (p. 32)[WI4BWLFBV7], Insurance Management I (p. 31)[WI4BWLFBV6]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: [2520320]

Coordinators: W. Heller
Part of the modules: Econometrics and Statistics II (p. 92)[WI4STAT6], Econometrics and Statistics I (p. 91)[WI4STAT5]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Workload

Course: Parametric Optimization [2550115]

Coordinators: O. Stein
Part of the modules: Mathematical Programming (p. 86)[WI4OR6]

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

Learning Control / Examinations
The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation.
The examination is held in the semester of the lecture and in the following semester.
Prerequisite for admission to the written examination is attaining at least 30% of the exercise points. Therefore the online-registration for the written examination is subject to fulfilling the prerequisite.

Conditions
None.

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

Learning Outcomes
The student

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

Content
Parametric Optimization deals with the impact of parameter changes on the solution of optimization problems. In practical applications this is of fundamental importance, for example, to assess the quality of a numerically computed solution or to derive quantative statements about its parameter dependence. Moreover, many optimization algorithms are controlled by variing parameters, and applications may be found in noncooperative game theory, geometric optimization and robust optimization. The lecture provides a mathematically sound introduction to these topics and is structured as follows:

- Introductory examples and terminology
- Stability and regularity conditions
- Sensitivity
- Applications: semi-infinite optimization and Nash games

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Lecture notes.

Literature
Elective literature:

- J.F. Bonnans, A. Shapiro, Perturbation Analysis of Optimization Problems, Springer, New York, 2000.
- W. Dinkelbach, Sensitivitätsanalysen und parametrische Programmierung, Springer, Berlin, 1969.
- J. Guddat, F. Guerra Vasquez, H.Th. Jongen, Parametric Optimization: Singularities, Pathfollowing and Jumps, Wiley, Chichester, and Teubner, Stuttgart, 1990.
- R.T. Rockafellar, R.J.B. Wets, Variational Analysis, Springer, Berlin, 1998.

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

Course: Patent Law [24656]

Coordinators: P. Bittner
Part of the modules: Intellectual Property Law (p. 152)[WI4JURA4]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
It is the aim of this course to provide students with knowledge in the area of patent law and the business of technical intellectual property that builds upon, and goes beyond the knowledge the students have already acquired in the general lecture of *Industrial and intellectual property law*. Students shall understand how the legal rules depend upon, and interact with, the economic background and the legislative policy in the field of technical intellectual property, particularly in the field of information and communication technologies. Students shall learn about the rules of national, European and international patent law as well as know-how protection law and to apply these legal rules in practical cases, in particular in the area of utilizing technical intellectual property through agreements and lawsuits. The conflict between the monopoly of a patent and the antitrust law policies in Europe will be reviewed with the students.

Content
The course deals with the subject matter of the law of technical intellectual property, in particular inventions, patents, utility models, design patents, know-how, the rights and obligations of employees as creators of technical IP, licensing, limitations and exceptions to patenting, term of protection, enforcement of the rights and defence against these in invalidation and revocation actions. The course does not merely focus on German patent law, but likewise puts European, US and international patent law into perspective. Students shall understand how the legal rules depend upon, and interact with, the economic background and the legislative policy in the field of technical intellectual property, particularly in the field of information and communication technologies. Students shall learn about the rules of national, European and international patent law as well as know-how protection law and to apply these legal rules in practical cases, in particular in the area of utilizing technical intellectual property through agreements and lawsuits. The conflict between the monopolyöf a patent and the antitrust law policies in Europe will be reviewed with the students.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
transparancies

Literature

- Schulte, Rainer Patentgesetz Carl Heymanns Verlag, 7. Aufl. 2005 ISBN 3-452-25114-4
- Kraßer, Rudolf, Patentrecht Verlag C.H. Beck, 5. Aufl. 2004 ISBN 3-406-384552

Elective literature:
tba in the transparencies

Course: Personalization and Services [2540533]

Coordinators: A. Sonnenbichler
Part of the modules: Advanced CRM (p. 37)[WI4BWLISM1], Business & Service Engineering (p. 42)[WI4BWLISM4]

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

Learning Control / Examinations

Assessment consists of a written exam of 1 hour length following §4 (2), 1 of the examination regulation and by submitting written papers as part of the exercise following §4 (2), 3 of the examination regulation.
The course is considered successfully taken, if at least 50 out of 100 points are acquired in the written exam. In this case, all additional points (up to 10) from excersise work will be added. The grades of this lecture are assigned following the table below:

Grade	Minimum points
1.0	95
1.3	90
1.7	85
2.0	80
2.3	75
2.7	70
3.0	65
3.3	60
3.7	55
4.0	50
5.0	0

Conditions

None.

Learning Outcomes

The student

- knows the options and opportunities of personalization especially in the area of Internet based services
- knows important methods for authentication, authorization, and accounting
- can use these methods practically in internet-based services.

Content

Workload

The total workload for this course is approximately 135.0 hours. For further information see German version.

Media

Slides.

Remarks

As of summer term 2014 this lecture is hold in alternation with the lecture “2540506 - Recommendersystems”. The current schedule can be seen on the chair’s website (http://www.em.uni-karlsruhe.de/studies/).

Course: Photovoltaic Systems Technology [23380]

Coordinators: Schmidt
Part of the modules: Generation and transmission of renewable power (p. 143)[WI4INGETIT7]

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

Learning Control / Examinations
The assessment consists of an oral exam (20 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 summer semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Learning Outcomes
Students know the theoretical fundamentals of photovoltaic systems technology.

Content

- Introduction
- Ways of solar energy utilisation
- The terrestrial solar radiation
- Solar radiation measuring principles
- Fundamentals of solar cells
- Overview of typical cell technologies
- Efficiency values
- Equivalent circuit diagram of solar cells
- Properties of solar cells and solar modules
- Series and parallel connection of solar cells
- Matching of solar generators and loads
- MPP-Tracking
- Construction of PV-modules
- Partial shading, bypass-technologies
- Overview of different System configurations
- Batteries for PV applications
- Charge controllers
- Battery peripherals
- Inverters for stand-alone systems
- Inverters for grid connected systems
- European efficiency
- Safety and EMC aspects
- Annual yield of PV systems
- Economic evaluation of PV systems
- Examples of realised PV systems

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Copies of the main transparenvies will be distributed each lecture.

Literature
Elective literature:
„Regenerative Energiesysteme“, Volker Quaschning, ISBN: 978-3-446-40973-6
„Photovoltaik“, Heinrich Häberlin, ISBN:978-3-8007-3003-2

Course: Physics for Engineers [2142890]

Coordinators: P. Gumbsch, A. Nesterov-Müller, D. Weygand, T. Förtsch
Part of the modules: Microfabrication (p. 118)[WI4INGMBIMT2], Microsystem Technology (p. 122)[WI4INGMBIMT4]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	2/2	lecture + exercise	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (90 minutes) (following §4(2), 1 of the examination regulation).

Conditions
None.

Recommendations
Knowledge of bases in mechanics and optics are necessary.

Learning Outcomes
The student

- has the basic understanding of the physical foundations to explain the relationship between the quantum mechanical principles and the optical as well as electrical properties of materials
- can describe the fundamental experiments, which allow the illustration of these principles

Content
1) Foundations of solid state physics

- Wave particle dualism
- Tunnelling
- Schrödinger equation
- H-atom

2) Electrical conductivity of solids

- solid state: periodic potentials
- Pauli Principle
- band structure
- metals, semiconductors and isolators
- p-n junction / diode

3) Optics

- quantum mechanical principles of the laser
- linear optics
- non-linear optics

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

Literature

- Tipler und Mosca: Physik für Wissenschaftler und Ingenieure, Elsevier, 2004
- Haken und Wolf: Atom- und Quantenphysik. Einführung in die experimentellen und theoretischen Grundlagen, 7. Aufl., Springer, 2000

Course: Physical basics of laser technology [2181612]

Coordinators: J. Schneider
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Winter term	

Learning Control / Examinations
The assessment consists of an oral exam (30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered upon agreement.

Conditions
Basic knowledge of physics, chemistry and material science is assumed.
It is not possible, to combine this lecture with the lecture *Laser Application in Automotive Engineering* [2182642]

Recommendations
None.

Learning Outcomes
The student

-
- can explain the principles of light generation, the conditions for light amplification as well as the basic structure and function of different laser sources.
- can describe the influence of laser, material and process parameters for the most important methods of laser-based materials processing and choose laser sources suitable for specific applications.
- can illustrate the possible applications of laser sources in measurement and medicine technology
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Content
Based on the description of the physical basics about the formation and the properties of laser light the lecture goes through the different types of laser beam sources used in industry these days. The lecture focuses on the usage of lasers especially in materials engineering. Other areas like measurement technology or medical applications are also mentioned. An excursion to the laser laboratory of the Institute for Applied Materials (IAM) will be offered.

-
- physical basics of laser technology
- laser beam sources (solid state, diode, gas, liquid and other lasers)
- beam properties, guiding and shaping
- lasers in materials processing
- lasers in measurement technology
- lasers for medical applications
- savety aspects

The lecture is complemented by a tutorial.

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Media
lecture notes via ILIAS

Literature
W. T. Silfvast: Laser Fundamentals, 2008, Cambridge University Press
W. M. Steen: Laser Material Processing, 2010, Springer

Remarks
It is allowed to select only one of the lectures "Laser in automotive engineering" (2182642) or "Physical basics of laser technology" (2181612) during the Bachelor and Master studies.

Course: Simulation Game in Energy Economics [2581025]

Coordinators: W. Fichtner
Part of the modules: Energy Economics and Energy Markets (p. 49)[WI4BWLIIP4]

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

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

Conditions
Visiting the course "Introduction to Energy Economics"

Learning Outcomes
Students

- understand market mechanisms, pricing and investment decisions in a liberalised electricity market,
- apply methods and instruments in a subarea of "Energy Economics",
- choose the appropriate methods to solve given problems (unit dispatch, investment planning) and apply them,
- find and discuss arguments for solution approaches.

Content

- Introduction
- Agents and market places in the electricity industry
- Selected planning tasks of energy service companies
- Methods of modelling in the energy sector
- Agent-based simulation: The PowerACE model
- Simulation game: Simulation in energy economics (electricity and emission trading, investment decisions)

The lecture is structured in a theoretical and a practical part. In the theoretical part, the students are taught the basics to carry out simulations themselves in the practical part which comprises amongst others the simulation of the power exchange. The participants of the simulation game take a role as a power trader in the power market. Based on various sources of information (e.g. prognosis of power prices, available power plants, fuel prices), they can launch bids in the power exchange.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

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

Literature
Elective literature:
Möst, D. und Genoese, M. (2009): Market power in the German wholesale electricity market. The Journal of Energy Markets (47–74). Volume 2/Number 2, Summer 2009

Course: PLM for product development in mechatronics [2122376]

Coordinators: M. Eigner
Part of the modules: Virtual Engineering B (p. 110)[WI4INGMB30], Virtual Engineering A (p. 109)[WI4INGMB29]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2/0	lecture	Summer term	de

Learning Control / Examinations
The assessment consists of an oral exam (20 min) taking place in the recess period (according to §4 (2), 2 of the examination regulation.

Conditions
None.

Learning Outcomes
Students have a basic overview about product data management and product lifecycle management.
Students know components and core functions of PLM solutions
Students can describe trends in research and practice in the environment of PLM

Content

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Course: PLM-CAD Workshop [2121357]

Coordinators: J. Ovtcharova
Part of the modules: Virtual Engineering B (p. 110)[WI4INGMB30], Virtual Engineering A (p. 109)[WI4INGMB29]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	4	practical course	Winter / Summer Term	de

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Workload

The total workload for this course is approximately 120 hours. For further information see German version.

Course: Polymer Engineering I [2173590]

Coordinators: P. Elsner
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

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

Learning Control / Examinations
Oral examination

Duration: 20-30 Minutes

Conditions
None.

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

- are able to describe and classify polymers
  based on the fundamental synthesis processing techniques
- can find practical applications for state-of-the-art polymers and manufacturing technologies
- are able to apply the processing techniques, the application of polymers and polymer composites regarding to the basic principles of material science
- can describe the special mechanical, chemical and elctrical prooperties of polymers and correlate these properties to the chemical bindings.
- can define application areas and the limitation in the use of polymers

Content
1. Economical aspects of polymers
2. Introductiom of mechanical,
chemical end electrical properties
3. Processing of polymers
(introduction)
4. Material science of polymers
5. Synthesis

Workload
regular attendance: 21 hours
self-study: 99 hours

Literature
Recommended literature and selected official lecture notes are provided in the lecture

Course: Polymer Engineering II [2174596]

Coordinators: P. Elsner
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

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

Learning Control / Examinations
Oral examination

Duration: 20-30 Minutes

Conditions
Polymerengineering I

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

- can describe and classify different processing techniques
  and can exemplify mould design principles based on technical parts.
- know about practical applications and processing of polymer parts
- are able to design polymer parts according to given restrictions
- can choose appropriate polymers based on the technical requirements
- can decide how to use polymers regarding the production, economical and ecological requirements

Content
1. Processing of polymers
2. Properties of polymer components
Based on practical examples and components
2.1 Selection of material
2.2 Component design
2.3 Tool engineering
2.4 Production technology
2.5 Surface engineering
2.6 Sustainability, recycling

Workload
regular attendance: 21 hours
self-study: 99 hours

Literature
Recommended literature and selected official lecture notes are provided in the lecture

Course: Polymers in MEMS A: Chemistry, Synthesis and Applications [2141853]

Coordinators: B. Rapp
Part of the modules: Microfabrication (p. 118)[WI4INGMBIMT2], Microsystem Technology (p. 122)[WI4INGMBIMT4]

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

Learning Control / Examinations
The assessment consists of an oral exam (20 min) taking place in the recess period (according to §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 aim of the lecture is providing mechanical or chemical engineers, as well as interested students from the life or material sciences the basic knowledge required for understanding what polymers are and how they are made, highlighting their importance for modern MEMS systems with a wide view to applications in everyday life.
After attending the lecture the students will be able:

- ... to understand the physic/chemical basics of organic chemistry in polymer synthesis.
- ... to state the most important polymers and polymer classes and to develop application examples for these.
- ... to state the most important polymers in MEMS.
- ... to understand the most important techniques for rapid prototyping.
- ... to state and to understand the most important resists in MEMS.
- ... to understand the chemical synthesis of polymers.

... to correctly estimate the application scope of the individual classes of polymers.

Content
We all come in contact with numerous polymeric products in everyday life. From water bottles to packaging to the cover of the iPad, many things are made of polymers. Polymers are also important materials for modern microelectromechanical systems (MEMS) allowing cost effective mass market compatible products, e.g., in the life sciences or diagnostics. But polymers are not just cost-effective replacements for more expensive classical materials in MEMS (such as, e.g., silicon) – some polymers have intrinsic properties that make them ideal materials for sensors, actuators or templates for biology and chemistry in MEMS.
This lecture will introduce the basics of organic chemistry required for understanding what polymers are, how they are manufactured and which mechanisms are responsible for their unique properties. The lecture will highlight (in the context of MEMS but also in a wider scope) where and why polymers are applied with a strong focus on their chemical and physical properties (and on their synthesis).
Some of the topics covered are:

- What is the basic chemistry of polymers? What are monomers, what are macromolecules and how are they formed?
- How are polymers produced on industrial scale – but also on the laboratory scale? Numerous examples of how to make (commonly and lesser known) polymers will be discussed including materials such as Plexiglas.
- Why are polymers so important for biochemistry and tissue engineering?
- How do photoresists work and why do some polymers contract when exposed to light?
- What are high-performance polymers and why do they have such a wide application range, e.g., in implants?
- What polymers fuel the household 3D printing community and what materials do 3D printers such as, e.g., the RepRap work with?
- How does 3D printing and rapid prototyping work and which polymers can be employed for which techniques?
- Why does silicone always smell like vinegar and why is this material so important for modern day microfluidics? How do you built fluid-logic devices using silicone?
- How do shape memory polymers remember their shape?
- What are polymer foams and why are they not only important for heat insulation but also for organic chemistry?
- How do glues work? Why are there two-component glues, what is superglue and how can you make glue from potatoes?

The lecture will be given in German language unless non-German speaking students attend. In this case, the lecture will be given in English (with some German translations of technical vocabulary). The lecture slides are in English language and will be handed out for taking notes. Additional literature is not required.
For further details, please contact the lecturer, Dr. Ing. Bastian E. Rapp (bastian.rapp@kit.edu). Preregistration is not necessary. The examination will be held in oral form at the end of the lecture. The second lecture of the lecture series “Polymers in MEMS B – Physics, manufacturing and applications” (which is also held in winter semester) can be combined with this lecture. In summer semester, the third part of the lecture series “Polymers in MEMS C – Biopolymers, Biopolymers and applications” will be given which may be combined with lectures A and B.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
The lecture slides will be given out as scriptum during each lecture course.

Remarks
For further details, please contact the lecturer, Dr. Ing. Bastian E. Rapp (bastian.rapp@kit.edu). Preregistration is not necessary.

Course: Polymers in MEMS B: Physics, Microstructuring and Applications [2141854]

Coordinators: M. Worgull
Part of the modules: Microfabrication (p. 118)[WI4INGMBIMT2], Microsystem Technology (p. 122)[WI4INGMBIMT4]

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

Learning Control / Examinations
The assessment consists of an oral exam (20 min) taking place in the recess period (according to §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 aim of the lecture is providing mechanical or chemical engineers, as well as interested students from the life or material sciences the basic knowledge required for understanding what polymers are and how they are made, highlighting their importance for modern MEMS systems with a wide view to applications in everyday life.
After attending the lecture the students will be able:

- . . . to understand the properties of polymers as a consequence of their morphology.
- . . . to describe the most important structuring techniques and technologies for polymers in MEMS.
- . . . to understand the mathematical basis of the most important physical models for polymers.
- . . . to correctly judge polymer properties and the applicability of the polymers for their industrial processability.
- . . . to understand the basics of process simulation in polymer structuring.
- . . . to state the most important technical thermoplasts in MEMS and to understand their properties.
- . . . to correctly classify the various types of polymers, blends, composite materials.

Content
We all come in contact with numerous polymeric products in everyday life. From water bottles to packaging to the cover of the iPad, many things are made of polymers. Polymers are also important materials for modern microelectromechanical systems (MEMS) allowing cost effective mass market compatible products, e.g., in the life sciences or diagnostics. But polymers are not just cost-effective replacements for more expensive classical materials in MEMS (such as, e.g., silicon) – some polymers have intrinsic properties that make them ideal materials for sensors, actuators or templates for biology and chemistry in MEMS.
This lecture will introduce the basics of physics and material science required for the understanding of the mechanical behavior seen from the engineers view. Micro and nanostructuring of polymers allows the fabrication of micro parts fulfilling their tasks in mostly invisible different applications. But also the fabrication of polymer parts with functional surfaces inspired from Bionics will be presented in this lesson. The lesson will give further an overview over the polymer based structuring processes and will underline the importance by a number of applications e.g. photonic structures or Lotus-like structures.
Some of the topics covered are:

- How can polymers described from the view of engineers?
- What are the differences between polymers and metals?
- Rheology of polymer melts – How does polymer melts flow?
- How can polymers be formed and demolded?
- Which structuring processes (replication) processes are available?
- How does stress influence molded parts (e.g. the deformation of a CD in a hot car)
- Shrinkage of polymers – which precision is achievable
- Gluing or welding – How can polymers be assembled?
- Simulation of replication processes
- Characterization of polymers – which properties can be measured?

The lecture will be given in German language unless non-German speaking students attend. In this case, the lecture will be given in English (with some German translations of technical vocabulary). The lecture slides are in English language and will be handed out for taking notes. Additional literature is not required.
For further details, please contact the lecturer, PD Dr.-Ing. Matthias Worgull (matthias.worgull@kit.edu). Preregistration is not necessary.
The examination will be held in oral form at the end of the lecture. The second lecture of the lecture series "„Polymers in MEMS A – Chemistry, synthesis and applications " (which is also held in winter semester) can be combined with this lecture. In summer

semester, the third part of the lecture series “Polymers in MEMS C – Biopolymers, Biopolymers and applications” will be given which may be combined with lectures A and B.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
The lecture slides will be given out as scriptum during each lecture course.

Remarks
For further details, please contact the lecturer, PD Dr.-Ing. Matthias Worgull (matthias.worgull@kit.edu). Preregistration is not necessary.

Course: Polymers in MEMS C - Biopolymers and Bioplastics [2142855]

Coordinators: M. Worgull, B. Rapp
Part of the modules: Microfabrication (p. 118)[WI4INGMBIMT2], Microsystem Technology (p. 122)[WI4INGMBIMT4]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
The assessment consists of an oral exam (20 min) taking place in the recess period (according to §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.

Recommendations
See German version.

Learning Outcomes
The aim of the lecture is providing mechanical or chemical engineers, as well as interested students from the life or material sciences the basic knowledge of biopolymers and bioplastics, highlighting their importance for modern MEMS systems with a wide view to applications in everyday life.
After attending the lecture the students will be able:

- . . . to correctly classify biopolymers and bioplastics.
- . . . to correctly state their properties, advantages and disadvantages.
- . . . to correctly estimate their application scope in MEMS.
- . . . to understand their usage in everyday life.
- . . . to correctly judge their sustainability.
- . . . to develop further applications of this class of materials.

. . . to correctly estimate the suitability of biopolymers and bioplastics, especially compared to conventionally polymers.

Content
Polymers are ubiquitous in everyday life: from packaging materials all the way to specialty products in medicine and medical engineering. Today it is difficult to find a product which does not (at least in parts) consist of polymeric materials. The question of how these materials can be improved with respect to their disposal and consumption of (natural) resources during manufacturing is often raised. Today polymers must be fully recycled in Germany and many other countries due to the fact that they do not (or only very slowly) decompose in nature. Furthermore significant reductions of crude oil consumption during synthesis are of increasing importance in order to improve the sustainability of this class of materials. With respect to disposal polymers which do not have to be disposed by combustion but rather allow natural decomposition (composting) are of increasing interest. Polymers from renewable sources are also of interest for modern microelectromechanical systems (MEMS) especially if the systems designed are intended as single-use products.
This lecture will introduce the most important classes of these so-called biopolymers and bioplastics. It will also discuss and highlight polymers which are created from naturally created analogues (e.g. via fermentation) to petrochemical polymer precursors and describe their technical processing. Numerous examples from MEMS as well as everyday life will be given.
Some of the topics covered are:

- What are biopolyurethanes and how can you produce them from castor oil?
- What are “natural glues” and how are they different from chemical glues?
- How do you make tires from natural rubbers?
- What are the two most important polymers for life on earth?
- How can you make polymers from potatoes?
- Can wood be formed by injection molding?
- How do you make buttons from milk?
- Can you play music on biopolymers?
- Where and how do you use polymers for tissue engineering?
- How can you built LEGO with DNA?

The lecture will be given in German language unless non-German speaking students attend. In this case, the lecture will be given in English (with some German translations of technical vocabulary). The lecture slides are in English language and will be handed out for taking notes. Additional literature is not required.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
The lecture slides will be given out as scriptum during each lecture course.

Literature
Additional literature is not required.

Remarks
For further details, please contact the lecturer, Dr. Ing. Bastian E. Rapp (bastian.rapp@kit.edu) and PD Dr.-Ing. Matthias Worgull (matthias.worgull@kit.edu). Preregistration is not necessary.

Course: Portfolio and Asset Liability Management [2520357]

Coordinators: M. Safarian
Part of the modules: Econometrics and Statistics II (p. 92)[WI4STAT6], Mathematical and Empirical Finance (p. 88)[WI4STAT1], Statistical Methods in Risk Management (p. 89)[WI4STAT2]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise	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

Workload
The total workload for this course is approximately 135 hours. For further information see German version.

Media
transparencies, exercises.

Literature
To be announced in lecture.
Elective literature:
To be announced in lecture.

Remarks
The credits for the course have been changed from 5 to 4,5 from winter term 2015/2016 on.

Course: [2142856]

Coordinators: M. Worgull, B. Rapp
Part of the modules: Microfabrication (p. 118)[WI4INGMBIMT2]

ECTS Credits	Hours per week	Type	Term	Instruction language
2	2	practical course	Summer term	de

Learning Control / Examinations
The practical course will close with an oral examination.There will be only passed and failed results, no grades.

Conditions
Having attended either "Polymers in MEMS A" or "Polymers in MEMS B" is a prerequisite for this practical course.
For further details, please contact the lecturer, Dr. Ing. Bastian E. Rapp (bastian.rapp@kit.edu) and PD Dr.-Ing. Matthias Worgull (matthias.worgull@kit.edu). Preregistration is mandatory. The number of participants is limited to 5 students.

Recommendations
Bachelor (or equivalent level) students with basic knowledge in material science and chemistry. Students must have attended either "Polymers in MEMS A" or "Polymers in MEMS B" during winter semester.

Learning Outcomes
The practical course will provide mechanical or chemical engineers, as well as interested students from the life or material sciences a deeper understanding of polymers, their synthesis and their processing.
After attending the lecture the students will be able:

- . . . to synthesize relevant polymers on a laboratory scale.
- . . . to characterize these materials.
- . . . to structure these polymers.

. . . to use these polymers in exemplary MEMS applications..

Content
This practical course complements the lectures "Polymers in MEMS A", "Polymers in MEMS B" and "Polymers in MEMS C" and will allow students to gain a deeper understanding of polymers and their processing. During the course of this practical course, various polymers will be synthesized and molded into components suitable for microelectromechanical systems (MEMS) applications. The aim of the course is to bring a polymer all the way from synthesis to application.
The practical course will be given in German language unless non-German speaking students attend. In this case, the course will be given in English (with some German translations of technical vocabulary). Lecture notes for the experiments are in English language and will be handed out to the students. The practical course will be held "en block" at the end of the semester (presumably beginning of October)
For further details, please contact the lecturer, Dr. Ing. Bastian E. Rapp (bastian.rapp@kit.edu) and PD Dr.-Ing. Matthias Worgull (matthias.worgull@kit.edu). Preregistration is mandatory. The number of participants is limited to 5 students.

Workload

- practical course: 3 * 8 h (24 h)
- experiment preparation (before and after lecture): 30 h

preparation of final exam: 66 h

Media
descriptions of the experiments

Literature
Scripts of the corresponding lectures, further literature as named there.

Course: Laboratory “Laser Materials Processing” [2183640]

Coordinators: J. Schneider, W. Pfleging
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

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

Learning Control / Examinations
The assessment consists of a colloquium for every single experiment and an overall final colloquium incl. an oral presentation of 20 min (according to Section 4(2), 3 of the examination regulation).

Conditions
The attendance to one of the courses *Physical Basics of Laser Technolog*y and *Laser Application in Automotive Engineering* is required.

Recommendations
The attendance to one of the courses Physical Basics of Laser Technology (2181612) or Laser Application in Automotive Engineering (2182642) is strongly recommended.

Learning Outcomes
The student

- can describe the influence of laser, material and process parameters and can choose suitable parameters for the most important methods of laser-based processing in automotive engineering.
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Content
The laboratory compromises 8 half-day experiments, which address the following laser processing topics of metals, ceramics and polymers:
• safety aspects
• surface hardening and remelting
• melt and reactive cutting
• surface modification by dispersing or alloying
• welding
• surface texturing
• metrology
There are used CO_2-, excimer-, Nd:YAG- and high power diode-laser sources within the laboratory.

Workload
The total workload for this course is approximately 30 hours. For further information see German version.

Media
lecture notes via ILIAS

Literature
W.T. Silfvast: Laser Fundamentals, 2008, Cambrigde University Press
W.M. Steen: Laser Materials Processing, 2010, Springer

Remarks
Credits: 4 (dependent on context)!

Course: Practical Course Technical Ceramics [2125751]

Coordinators: R. Oberacker
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

ECTS Credits	Hours per week	Type	Term	Instruction language
1	2	practical course	Winter term	de

Learning Control / Examinations
The assessment consists of an colloquium and a report to every single experiment (according to Section 4(2), 3 of the examination regulation).

Conditions
Attendance of one course in the area of ceramics is assumed.

Recommendations
None.

Learning Outcomes
The students are able to understand and to apply a number of basic laboratory methods used in processing and characterization of ceramic materials. They are qualified to apply new methods on the basis of standards and descriptions of experiments.

Content
Based on alumina as a model material, major test methods for the characterization of raw materials, intermediate and final products are practically applied. Topics:

- powder caracterization
- Shaping of powder compacts
- sintering
- microstructural characterization
- mechanical testing

On the basis of short descriptions of the methods, the students prepare themselfes, carry out the experiments and write a laboratory report.

Workload
The total workload for this course is approximately 30 hours.

Media
Slides for the practical:
available under http://ilias.studium.kit.edu

Literature
Salmang, H.: Keramik, 7. Aufl., Springer Berlin Heidelberg, 2007. - Online-Ressource

Richerson, D. R.: Modern Ceramic Engineering, CRC Taylor & Francis, 2006

Course: Experimental Laboratories in Sensors and Actuators [23232]

Coordinators: W. Menesklou
Part of the modules: Sensor Technology I (p. 140)[WI4INGETIT3], Sensor Technology II (p. 141)[WI4INGETIT5]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	4	practical course	Summer term	de

Learning Control / Examinations
Assessment consists of written examinations about basics of the experiment, the evaluation of the practical implementation, and the evaluation of the protocols.
The overall grade consists of the partial grades of the all examinations.

Conditions
See module description.
Successful completion of sensors [23231].

Recommendations
The number of participants is limited, early registration is recommended.

Learning Outcomes
The student should acquire fundamental principles in material science and device technology of sensors and actors to be able to apply materials and sensors from the viewpoint of an application or development engineer.

Content
In groups of three, the students measure autonomously the relevant characteristics of materials, sensors and actuators. Insights may be gained into the fundamental physical mechanism and also the factors determining the design and development of components utilizing these materials. The students should acquire the capability to analyze and present experimental data, and should be able to discuss the technological and economical boundary conditions.
Content: Impedance spectroscopy, Piezoelectric sensor and actuator, Temperature sensors (NTC, PTC), Exhaust gas sensors, (lambda probes), Magnetic sensors (Hall sensor), Intelligent shock absorber (adaptronic system), Scientific presentation.

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

Media
Online material is available at http://www.iwe.kit.edu

Course: Computing Lab Information Systems [PraBI]

Coordinators: A. Oberweis, R. Studer
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2	practical course	Winter / Summer Term	de

Learning Control / Examinations
The assessment of this course are practical work, presentations and a written thesis according to §4(2), 3 of the examination regulation. Practical work, presentations and a written thesis are weighted according to the course.

Conditions
None.

Learning Outcomes
Students are able to

- implement a prototype at the computer based on the given topic,
- write the thesis to present the results and the development process,
- give presentations in a scientific context in front of an auditorium to present the results.

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

Workload
Warning: not a valid latex tabular environment.

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: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

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

Learning Control / Examinations
The assessment consists of (according Section 4(2), 3 of the examination regulation):

- practical work
- oral presentation of the results
- written report
- discussion and collaboration

Conditions
None.

Learning Outcomes
See German version.

Content
Topics include the new research issues of the research group “applied Informatics”. The new topics are in the area Organic Computing, Nature-inspired optimization and service oriented architectures.
The methods presented in the lectures are practiced during this laboratory in teamwork including implementation tasks. The results should be presented by an oral presentation and a written report.
The topics of the laboratory are introduced around the end of the former semester on the board A12 of the institute AIFB (building 11.40) and in Internet http://www.aifb.kit.edu/web/SeminarePraktika

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Literature
Elective literature:
Will be announced at the beginning of the computer lab.

Remarks
There is a limited number of participants. Therefore students have to register for the lab.

Course: Exercises in Knowlegde Management [25740p]

Coordinators: R. Studer
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

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

Learning Control / Examinations
Assessment is based on equal parts on (acc. to §4(2), 3 SPO)

- Essay
- Presentation
- Implementation

Conditions
Attending the lecture “Wissensmanagement” [25860] is required.

Learning Outcomes
Students

- are able to independently work out a project in the domain of knowledge management

Content
This “Praktikum” covers one of the following topics (the topics rotate annually):

- Ontologie-based Knowledge Management
- Semantic Web and Linked Data Applications
- Social Software and Collaboration Tools
- Data and Web Mining
- Personal Knowledge Management
- Case-based Reasoning

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

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: Introduction to Microsystem Technology - Practical Course [2143875]

Coordinators: A. Last
Part of the modules: Nanotechnology (p. 124)[WI4INGMBIMT5], BioMEMS (p. 116)[WI4INGMBIMT1], Microoptics (p. 120)[WI4INGMBIMT3], Microsystem Technology (p. 122)[WI4INGMBIMT4], Microfabrication (p. 118)[WI4INGMBIMT2]

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

Learning Control / Examinations
The assessment consists of a written exam (60 minutes) (following §4(2), 1 SPO).

Conditions
None.

Recommendations
Courses Microsystem technology I [2141861] and II [2142874] are recommended.

Learning Outcomes

- Deepening of the contents of the lecture MST I resp. II
- Understanding the technological processes in the micro system technology
- Experience in lab-work at real workplaces where normally research is carried out

Content
In the practical training includes nine experiments:
1. Hot embossing of plastics micro structures
2. Micro electroforming
3. Mikro optics: „LIGA-micro spectrometer“
4. UV-lithography
5. Optical waveguides
6. Capillary electrophoresis on a chip
7. SAW gas sensor
8. Metrology
9. Atomic force microscopy

Each student takes part in only five experiments.
The experiments are carried out at real workstations at the IMT and coached by IMT-staff.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

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. 84)[WI4OR5]

ECTS Credits	Hours per week	Type	Term	Instruction language
7	2/1/2	seminar	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists in a case study, the writing of a corresponding paper, and an oral exam (according to §4(2), 2 of the examination regulation).

Conditions
None.

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

Learning Outcomes
The student

- is familiar with real problems arising in a hospital
- develops solution approaches for these problems by using well-known methods of Operations Research,
- is able to analyze processes and structures, to collect relevant data as well as to develop and solve models for hospital-specific problems.

Content
Processes in a hospital are often grown historically ("We have always done it this way"), so that there has not been the need to analyze processes until reforms of the health system have put increasing pressure on hospitals. Consequently, nowadays hospitals look for possibilities to improve their processes. The students are confronted with case studies and are asked to develop a solution. Therefore they have to collect and analyze relevant data , processes and structures. When developing the solution the students have to bear in mind that besides the economic efficiency also the quality of care and patient satisfaction (e.g. measured in waiting time) may not be neglected in the health care sector.

Workload
The total workload for this course is approximately 210 hours. For further information see German version.

Literature
Elective literature:

- Fleßa: Grundzüge der Krankenhausbetriebslehre, Oldenbourg, 2007
- Fleßa: Grundzüge der Krankenhaussteuerung, Oldenbourg, 2008
- Hall: Patient flow: reducing delay in healthcare delivery, Springer, 2006

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

Course: Predictive Mechanism and Market Design [2520402]

Coordinators: P. Reiss
Part of the modules: Applied Strategic Decisions (p. 63)[WI4VWL2], Experimental Economics (p. 74)[WI4VWL17]

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

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

Conditions
None.

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

Learning Outcomes
Students

- are provided with theoretical predictions in a variety of applications of mechanism and market design;
- learn about the robustness and usefulness of theoretical predictions in mechanism and market design;
- shall be able to design mechanisms and market for real-life problems.

Content
Frequently economic agents - individuals, firms, the government - need to define allocation mechanisms and can design the rules of market interactions. Examples include the provision of public goods (e.g., the reduction of CO_2 emissions), the solution of matching problems (e.g., the assignment in kidney exchange), resource allocation (e.g., radio spectrum usage rights), and procurement (e.g., choice of supplier and contractual terms). Theoretical predictions are derived and confronted with data from the laboratory and the field. The course focusses on the interplay of theory with evidence to learn about the accuracy and the robustness of the theoretical predictions.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Slides, problem sets.

Literature
A selection of published papers is compulsory reading for the course. The course syllabus provides references and is announced at the beginning of the course.

Remarks
See German version.

Course: Price Negotiation and Sales Presentations [2572198]

Coordinators: M. Klarmann, M. Schröder
Part of the modules: Sales Management (p. 53)[WI4BWLMAR6]

ECTS Credits	Hours per week	Type	Term	Instruction language
1,5	1	other	Winter term	de

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Recommendations
None.

Learning Outcomes
Students

- gain a clear impression of the theoretical knowledge about price negotiations and sales presentations
- improve their own negotiation abilities

Content

Workload
The total workload for this course is approximately 45.0 hours. For further information see German version.

Course: Pricing [2572157]

Coordinators: J. Kim

Part of the modules: Strategic Decision Making and Organization (p. 34)[WI4BWLUO4], Sales Management (p. 53)[WI4BWLMAR6], Services Marketing (p. 56)[WI4BWLMAR9], Strategy, Communication, and Data Analysis (p. 54)[WI4BWLMAR7], Cross-functional Management Accounting (p. 36)[WI4BWLIBU2]

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

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

Conditions
None.

Learning Outcomes
See German version.

Content
This course addresses central elements and peculiarities of pricing goods and services. The topics are below others:

- Price demand functions
- Concept of the price elasticity of demand
- Key concepts of behavioral pricing
- Decision-making areas in pricing

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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

Course: Principles of Insurance Management [2550055]

Coordinators: U. Werner
Part of the modules: Insurance Management II (p. 32)[WI4BWLFBV7], Insurance Management I (p. 31)[WI4BWLFBV6]

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

Workload
The total workload for this course is approximately 135.0 hours. For further information 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.

Course: Private and Social Insurance [2530050]

Coordinators: W. Heilmann, K. Besserer
Part of the modules: Insurance Management II (p. 32)[WI4BWLFBV7], Insurance Management I (p. 31)[WI4BWLFBV6]

ECTS Credits	Hours per week	Type	Term	Instruction language
2,5	2/0	lecture	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.

Workload
The total workload for this course is approximately 75.0 hours. For further information see German version.

Literature
Elective literature:

- F. Büchner, G. Winter. Grundriss der Individualversicherung. 1995.
- P. Koch. Versicherungswirtschaft. 2005.
- Jahrbücher des GDV. Die deutsche Versicherungswirtschaft:
  http://www.gdv.de/2011/11/jahrbuch-der-deutschen-versicherungswirtschaft-2011/

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

Course: Exercises in Civil Law [24506]

Coordinators: T. Dreier
Part of the modules: Commercial Law (p. 151)[WI4JURA2]

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

Learning Control / Examinations
The assessment is explained in the module description.
Bedingungen

Conditions
None.

Learning Outcomes
The students are able to solve legal cases by way of the appropriate legal technique (so-called Subsumtion). and to solve practical legal problems in a methodologically correct way.

Content
In 5 sessions the substantive law twhich students have been taught in the courses "Civil Law for Beginners", "Advanced Civil Law" and "Commercial and Corporation Law" will be repeated and the method for solving legal cases deepend. Moreover, 5 sessions ae reserved to written exam problems which cover the totality of what students have learned so far. Aditional sessions are reserved for the subsequent in-class discussion of the exam problems.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Slides

Literature
tba in the course.

Course: Problem solving, communication and leadership [2577910]

Coordinators: H. Lindstädt
Part of the modules: Strategic Corporate Management and Organization (p. 33)[WI4BWLUO1]

ECTS Credits	Hours per week	Type	Term	Instruction language
2	1/0	lecture	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (30 minutes) (following §4(2), 1 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Recommendations
None.

Learning Outcomes
After passing this course students are able to

- structure problem solving processes.
- apply the principles of focused communication based on charts and presentations.
- understand leadership in the context of situation and personality.

Content
The course deals with various aspects of problem solving and communication processes and is divided into two parts. The first part of the course addresses the fundamental steps in the problem-solving process; namely, problem identification, problem structuring, problem analysis and communication of solution. Ideas for structuring problem solving processes will be discussed and the perquisites for and principles of structured communication based on charts and presentations will be explained. The second part of the course addresses important concepts in leadership, including the context-specificity of influence, the choice of leader and the characteristics of employees. The course content reflects current issues in management and communication practice and is oriented toward the practical application of theoretical insights to these issues. In this respect, the course aims to develop interdisciplinary skills.

Workload
The total workload for this course is approximately 60 hours. For further information see German version.

Media
Slides.

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

Course: Product and Innovation Marketing [2571154]

Coordinators: M. Klarmann
Part of the modules: Marketing Management (p. 51)[WI4BWLMAR5], Cross-functional Management Accounting (p. 36)[WI4BWLIBU2], (p. 77)[WI4VWL19]

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

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

Conditions
None.

Learning Outcomes
See German version.

Content
This course addresses topics around the management of new as well as existing products. After the foundations of product management, especially the product choice behavior of customers, students get to know in detail different steps of the innovation process. Another section regards the management of the existing product portfolio.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

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

Course: Production and Logistics Controlling [2500005]

Coordinators: H. Wlcek

Part of the modules: Global Production and Logistics (p. 111)[WI4INGMB31], Material Flow in Networked Logistic Systems (p. 105)[WI4INGMB26], Logistics in Value Chain Networks (p. 108)[WI4INGMB28], Technical Logistics (p. 106)[WI4INGMB27], Material Flow in Logistic Systems (p. 104)[WI4INGMB25], Introduction to Logistics (p. 99)[WI4INGMB20]

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

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

Conditions
None.

Recommendations
See German version.

Learning Outcomes
See German version.

Content
See German version.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Production and Logistics Management [2581954]

Coordinators: M. Fröhling
Part of the modules: Industrial Production III (p. 47)[WI4BWLIIP6]

ECTS Credits	Hours per week	Type	Term	Instruction language
5,5	2/2	lecture + exercise	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (90 minutes) (following § 4(2), 1 of the examination regulation). The exam takes place in every semester. Reexaminations are offered at every ordinary examination date.

Conditions
None.

Learning Outcomes

- Students discuss the basic tasks of an operative production and logistics management.
- Students discuss approaches to solve these tasks and shall be able to apply certain ones.
- Students explain the interdependencies between the tasks and methods to solve.
- Students discuss possible IT tools for production and logistics management.
- Students describe emerging trends in production and logistics management.

Content
This course covers central tasks and challenges of operational production and logistics management. Systems analytically, central planning tasks are discussed. Exemplary solution approaches for these tasks are presented. Further practical approaches are explained. Students get to know the set-up and mode of operation of planning systems such as PPS-, ERP- and Advanced Planning Systems to cope with the accompanying planning tasks. Alongside to MRP II, students will be introduced to integrated supply chain management approaches in Supply Chain Management.

Workload
Total effort required will account for approximately 165h (5.5 credits).

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

Literature
will be announced in the course

Course: Production Technology and Management in Automotive [2149001]

Coordinators: V. Stauch, S. Peters
Part of the modules: Specialization in Production Engineering (p. 101)[WI4INGMB22], Global Production and Logistics (p. 111)[WI4INGMB31]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2	lecture + exercise	Winter term	de

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

Conditions
None

Recommendations
None

Learning Outcomes
The students . . .

- are capable to specify the current challenges in automotive industry and to explain approaches to solve them.
- are able to classify the main parts of an automotive plant and its key elements (production facilities).
- are qualified to identify interlinkages between development processes and production systems (such as lean production).
- have the ability to classify modern concepts of logistics and tasks in management and design of value added networks.
- are enabled to explain the importance of an integrated quality management in product development and production as well as related methods.
- are able to characterize methodical approaches of analytical assessment and optimization of production planning tasks.

Content
The lecture deals with the technical and organizational aspects of automotive production. The course starts with an introduction to the automotive industry, current trends in vehicle technology and integrated product development. A selection of manufacturing processes are subjects of the second lecture block. Experiences of the applications of the Mercedes Production System in production, logistics and maintenance are the subject of the third event. During the last block approaches to quality management, global networks and current analytical planning methods in research are discussed. The course is strongly oriented towards the practice and is provided with many current examples. Mr. Stauch was Head of Powertrain Production Mercedes Benz Cars and plant manager Untertürkheim until 2010.
The following topics will be covered:

- Introduction to Automotive Industry and Technology
- Basics of Product Development
- Selected Automotive Manufacturing Technologies
- Automotive Production Systems
- Logistics
- Quality Assurance
- Global Networks
- Analytical Approaches of Production Planning

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
Lecture slides will be provided printed.

Literature
Lecture Slides

Remarks
The lecture will be offered in winter semester 2015/2016 for the last time. The last examination will be in August 2016. The last chance for a reexamination will be in March 2017. There are only written exams.

Course: Programming Internship: Solving Computational Risk and Asset Management Problems [2530352]

Coordinators: M. Ulrich
Part of the modules: Computational Finance (p. 29)[WI4BWLFBV12]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2	practical course	Winter term	en

Learning Control / Examinations
There are weekly learning controls in the form of weekly programming problem sets. During the first three weeks, problem sets are voluntary to set expectations on the workload and degree of difficulty that is to be expected. Starting in week 4, all weekly problem sets are part of the course wide exam. The final course grade coincides with the equal weighted average across all weekly programming problem sets (starting in week 4). It is planned that programming problem sets can be solved in a group of 2 students. Every student has to submit his own solution and must document for which part of the solution he has been responsible (to satisfy KIT exam regulations). More information will be shared at the first day of class.

Conditions
The lecture Computational Risk and Asset Management has to be attended in the same semester.

Recommendations
None.

Learning Outcomes
Under supervision, students will implement / apply the following concepts (using modern software tools)
A) Statistical Machine Learning for predicting asset returns and risk densities
1. 'Supervised learning' with linear models: regression, maximum likelihood, Kalman Filter, VAR, impulse response analysis, causality
2. 'Supervised learning' with non-linear models: NLS, maximum likelihood, non-linear Kalman Filter, expectation maximization
3. Frequency and Bayesian way of estimating 'simple' asset pricing models
4. 'Unsupervised learning': PCA, SVD
B) Financial Concepts
1. CAPM, Fama-French and factor models to predict returns
2. Fama-MacBeth regressions to estimate risk premiums
3. Optimal portfolio allocation (Markowitz)
4. GARCH modeling to predict risk
5. Predicing interest rates
C) Essential numerical tool kit for
1. Determining fixed points
2. Finding roots
3. Simulating random numbers
4. Matrix inversion
5. Solving integrals and differential equations
6. Optimizing functions

Content
The courses teaches students how to solve current risk and asset management challenges using modern software tools. These problems will be based on current academic research and/or industry articles. Students will apply concepts from the lecture "Computational Risk and Asset Management" to translate these problems into models and to empirically validate them. The course provides hands-on experience in applying concepts from quant finance, statistical machine learning, empirical asset pricing and numerics. We will also critically question the empirical validation results in order to derive conclusions on how to further improve exising financial models.

Workload
The total workload for this course is approximately 135 hours. For further information see German version.

Remarks
New course starting winter term 2015/16.

Course: Project Management [n.n.]

Coordinators: F. Schultmann
Part of the modules: Industrial Production III (p. 47)[WI4BWLIIP6]

ECTS Credits	Hours per week	Type	Term	Instruction language
3,5	2/1	lecture	Winter term	en

Learning Control / Examinations
The examination will be in form of a written exam acc. to §4(2), 1 ER. Exams are offered in every semester and can be re-examined at every ordinary examination date.

Conditions
None.

Recommendations
None.

Learning Outcomes
The students get to know the context, rationale, strategy and tactics of project management with emphasis on the importance of project planning and project control and by identifying and examining project phases. The students discuss various approaches and standards of project management. They explain the iterative processes and the core skills required by successful project managers. The context and learning of the course enable the participants to apply project management skills to projects in a variety of industries including engineering, information technology, consulting, production, procurement, maintenance, logistics and supply chain, construction, and manufacturing. By focussing on providing knowledge in core areas of scope, time, cost and quality, and facilitating areas of risk, procurement, HR, integration, and communication management, the participants are able to confidently deal with the ever growing complexities and challenges of project management.

Content

1. Introduction
2. Principles of Project Management
3. Project Scope Mangement
4. Time Management and Resource Scheduling
5. Cost Management
6. Quality Management
7. Risk Management
8. Stakeholder
9. Communication, Negotiation and Leadership
10. Project Controlling

Workload
The total workload for this course is approximately 105 hours. For further information see German version.

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

Literature
Will be announced in the course.

Remarks
The course will be offered from winter term 2015/16 and replace the course “The Management of R&D Projects with Case Studies [2581963]”.

Course: Project Workshop: Automotive Engineering [2115817]

Coordinators: F. Gauterin, M. Gießler, M. Frey
Part of the modules: Automotive Engineering (p. 93)[WI4INGMB5], Vehicle Development (p. 95)[WI4INGMB14], Handling Characteristics of Motor Vehicles (p. 94)[WI4INGMB6]

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

Learning Control / Examinations
Performance is assessed on the basis of a project presentation at the end of the lecture period (according to Section 4(2), 3 of the examination regulation), the followed discussion and a final project report.
Re-examinations are offered at every ordinary examination date.
The overall grade of the course consists of the weighted grades of both assessments
• Processing and results of the project: 75%
• Oral exam: 25 percent

Conditions
None.

Recommendations
None.

Learning Outcomes
The students are familiar with typical industrial development processes and working style. They are able to apply knowledge gained at the university to a practical task. They are able to analyze and to judge complex relations. They are ready to work self-dependently, to apply different development methods and to work on approaches to solve a problem, to develop practice-oriented products or processes.

Content
During the Project Workshop Automotive Engineering a team of six persons will work on a task given by an German industrial partner using the instruments of project management. The task is relevant for the actual business and the results are intended to be industrialized after the completion of the project workshop.

The team will generate approaches in its own responsibility and will develop solutions for practical application. Coaching will be supplied by both, company and institute.

At the beginning in a start-up meeting goals and structure of the project will be specified. During the project workshop there will be weekly team meetings. Also a milestone meeting will be held together with persons from the industrial company. In a final presentation the project results will be presented to the company management and to institute representatives.

Workload
The total workload for this course is approximately 135 hours. For further information see German version.

Literature
Steinle, Claus; Bruch, Heike; Lawa, Dieter (Hrsg.), Projektmanagement, Instrument moderner Innovation, FAZ Verlag, Frankfurt a. M., 2001, ISBN 978-3929368277

The scripts will be supplied in the start-up meeting.

Remarks
Selection procedure, applications are to submit in the end of the preceding semester.

Course: Projectseminar [SozSem]

Coordinators: G. Nollmann, Kunz, Haupt, Grenz, Eisewicht, Enderle, Dukat, Albrecht
Part of the modules: Sociology (p. 156)[WI4SOZ1]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2	seminar	Winter / Summer Term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes
The student:

- Is able to develop sociological analyses based on the topic of the seminar
- Is able to organize a small survey or to evaluate a given data set on the research problem

Content
In this class, students will conduct small empirical projects.

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Course: Project Studies [6241826]

Coordinators: S. Gentes
Part of the modules: Process Engineering in Construction (p. 135)[WI4INGBGU22]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	1/1	lecture + exercise	Summer term	

Learning Control / Examinations
The assessment consists of an oral exam (ca. 20 min) taking place in the recess period (according to §4 (2), 2 of the examination regulation).

Conditions
None.

Recommendations
None.

Learning Outcomes
See German version.

Content
See German version.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
See German version.

Course: Public Management [2561127]

Coordinators: B. Wigger, Assistenten
Part of the modules: Collective Decision Making (p. 73)[WI4VWL16], Strategic Decision Making and Organization (p. 34)[WI4BWLUO4], Advanced Topics in Public Finance (p. 76)[WI4VWL18]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2	lecture	Winter term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following Art. 4, para. 2, clause 1 of the examination regulation. The grade for this course equals the grade of the written exam.

Conditions
Basic knowledge of Public Finance is required.

Learning Outcomes
See German version.

Content
The lecture „Public Management“ deals with the economic theory of public sector administration. It is divided into four parts. The first section gives an overview of the legal framework of governmental administration in the Federal Republic of Germany and introduces the classical theory of administration as developed by Weber. Part two studies concepts of public decision-making, which have a significant impact on the operation of public sector administrations and where one focus is on consistency problems of collective decision-making. The third chapter deals with efficiency problems arising in conventionally organized public administrations and companies. X-inefficiency, information and control problems, the isolated consideration of income-spending-relations as well as rent-seeking problems will be considered. In section four the concept of New Public Management, which is a new approach to public sector administration that is mainly based in contract theory, is introduced. Its foundations in institutional economics are developed, with a focus on the specific incentive structures in self-administered administrations. Finally, the achievements of New Public Management approaches are discussed.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Elective literature:

- Damkowski, W. and C. Precht (1995): Public Management; Kohlhammer
- Richter, R. and E.G. Furubotn (2003): Neue Institutionenökonomik; 3rd edition; Mohr
- Schedler, K. and I. Proeller (2003): New Public Management; 2nd edition; UTB
- Mueller, D.C. (2009): Public Choice III; Cambridge University Press
- Wigger, B.U. (2006): Grundzüge der Finanzwissenschaft; 2nd edition; Springer

Course: Advanced powder metals [2126749]

Coordinators: R. Oberacker
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

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

Learning Control / Examinations
The assessment consists of an oral exam (20-30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered upon agreement.

Conditions
None.

Recommendations
Knowledge of basic material science is assumed. Therefore it is recommended to attend the courses Material Science I [21760] and Material Science II [21782] beforehand.

Learning Outcomes
The students know the basics of powder metallurgy. They are able to assess the conditions for applying either powder metallurgy or competing production methods. They have knowledge on production, properties and application of the most important PM materials.

Content
The lecture gives an overview on production, properties and application of structural and functional powder metallurgy material. The following groups of materials are presented: PM High Speed Steels, Cemented Carbides, PM Metal Matrix Composites, PM Specialities, PM Soft Magnetic and Hard Magnetic Materials.

Workload
regular attendance: 22 hours
self-study: 98 hours

Media
Slides for the lecture:
available under http://ilias.studium.kit.edu

Literature

- W. Schatt ; K.-P. Wieters ; B. Kieback. „.Pulvermetallurgie: Technologien und Werkstoffe“, Springer, 2007
- R.M. German. “Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005
- F. Thümmler, R. Oberacker. “Introduction to Powder Metallurgy”, Institute of Materials, 1993

Course: Quality Management [2149667]

Coordinators: G. Lanza
Part of the modules: Specialization in Production Engineering (p. 101)[WI4INGMB22], Global Production and Logistics (p. 111)[WI4INGMB31]

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

Learning Control / Examinations
Performance is assessed in the form of one written examination (as per §4(2), 1 SPO [study and examination regulations]) during the lecture-free period. The examination will take place once every semester and can be retaken at every official examination date.

Conditions
None

Recommendations
None

Learning Outcomes
The students . . .

- are capable to comment on the content covered by the lecture.
- are capable of substantially quality philosophies.
- are able to apply the QM tools and methods they have learned about in the lecture to new problems from the context of the lecture.
- are able to analyze and evaluate the suitability of the methods, procedures and techniques they have learned about in the lecture for a specic problem.

Content
Based on the quality philosophies Total Quality Management (TQM) and Six Sigma, the lecture deals with the requirements of modern quality management. Within this context, the process concept of a modern enterprise and the process-specic elds of application of quality assurance methods are presented. The lecture covers the current state of the art in preventive and non-preventive quality management methods in addition to manufacturing metrology, statistical methods and service-related quality management. The content is completed with the presentation of certication possibilities and legal quality aspects.
Main topics of the lecture:

- The term “quality”
- Total Quality Management (TQM) and Six Sigma
- Universal methods and tools
- QM during early product stages – product denition
- QM during product development and in procurement
- QM in production – manufacturing metrology
- QM in production – statistical methods
- QM in service
- Quality management systems
- Legal aspects of QM

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).

Literature
Lecture Notes

Remarks
None

Course: Quality Control I [2550674]

Coordinators: K. Waldmann
Part of the modules: Stochastic Modelling and Optimization (p. 87)[WI4OR7]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1/2	lecture + exercise + tutorial	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following Section 4(2), 1 of the examination regulation. Credit from the voluntary computer lab is accounted for in the overall grade raising the exam grade by a 2/3 step of a full grade (according to Section 4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
The participants will be enabled to apply modern methods of statistic quality management efficiently in the frame of total quality management. The discussion of practice-oriented case studies provides an overview of problem settings arising in each part of the production process and motivates the introduced statistic methods. The course provides profound knowledge in the areas of statistical process control utilizing modern control charts, acceptance sampling using multilayered sampling plans and the Design and Analysis of Experiments. The facultative computer exercise course comprises a practice-oriented case study in which the participants implements certain methods of quality management in order to analyze their performance.

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Blackboard, slides, flash-animations, java tools, simulation software.

Literature

- Lecture Notes
- Montgomery, D.C.: Introduction to Statistical Quality Control (5th ed), Wiley

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

Course: Quality Control II [2550659]

Coordinators: K. Waldmann
Part of the modules: Stochastic Modelling and Optimization (p. 87)[WI4OR7]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1/2	lecture + exercise + tutorial	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following Section 4(2), 1 of the examination regulation. Credit from the voluntary computer lab is accounted for in the overall grade raising the exam grade by a 2/3 step (according to Section 4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
The participants will be enabled to apply modern methods of statistic quality management efficiently in the frame of total quality management. The discussion of practice-oriented case studies provides an overview of problem settings arising in each part of the production process and motivates the introduced statistic methods. The course focuses on the methodological background of the reliability of complex systems, the estimation of lifetime distributions and maintenance. The facultative computer exercise course comprises a practice-oriented case study in which the participants implement certain methods of quality management in order to analyze their performance.

Content
Reliability Theory (structure function, reliability of complex systems, modeling and estimating lifetime distributions, systems with repair), Maintenance.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Blackboard, slides, flash-animations, java tools, simulation software.

Literature

- Lecture Notes
- Ross, S.M.: Introduction to Probability Models (5 ed). Academic Press, 1993.
- Kohlas, J.: Zuverlässigkeit und Verfügbarkeit. B.B. Teubner, Stuttgart 1987.
- Bironlini, A.: Qualität und Zuverlässigkeit technischer Systeme, Springer, Berlin, 1991.

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

Course: Quality Management of Food Processing [22205/6]

Coordinators: Schuchmann
Part of the modules: Principles of Food Process Engineering (p. 144)[WI4INGCV3], Specialization in Food Process Engineering (p. 145)[WI4INGCV4]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	1/1	lecture + exercise	Summer term	de

Learning Control / Examinations
See module description.

Conditions
None.

Learning Outcomes
The student

- knows quality assurance systems applied in food industry. Specifically he knows and understands the HACCP system und is able to explain it using an example from food production.
- knows physical analytical methods used in the context of a HACCP qualification. He/she understands the principle used in each case, knows when to apply it, and is able to interpret and assess data obtained.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Quantitative Methods in Energy Economics [2581007]

Coordinators: D. Keles, P. Plötz
Part of the modules: Energy Economics and Energy Markets (p. 49)[WI4BWLIIP4]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2/1	lecture + exercise	Winter term	en

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

Conditions
None.

Recommendations
None.

Learning Outcomes
The student

- knows and understands selected quantitative methods of energy economics
- is able to use selected quantitative methods of energy economics
- understands they range of usage, limits and is autonomously able to adress new problems by them.

Content
Energy economics makes use of many quantitative methods in exploration and analysis of data as well as in simulations and modelling. This lecture course aims at introducing students of energy economics into the application of quantitative methods and techniques as taught in elementary courses to real problems in energy economics. The focus is mainly on regression, simulation, time series analysis and related statistical methods as applied in energy economics.

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Course: Computer Integrated Planning of New Products [2122387]

Coordinators: R. Kläger
Part of the modules: Virtual Engineering B (p. 110)[WI4INGMB30], Virtual Engineering A (p. 109)[WI4INGMB29]

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

Learning Control / Examinations
The assessment consists of an oral exam (30 min) according to §4 (2), 2 of the examination regulation.
The grade corresponds to the grade of the oral exam.

Conditions
Limited number of participants, for selection procedure and registration see course homepage.

Recommendations
None.

Learning Outcomes
The students got a basic understanding of relations, procedures and structure elements of standard processes in product planning and are capable of using these as guidelines for planning of new products.
They acquired knowledge of requirements and options in choosing and applying the right methods and tools for an efficient and reasonable assistance for specific use cases.
The students are familiar with elements and methods of computer aided idea and innovation management. They acquired knowledge of simultaneous assistance to the product planning process by using the technologies of rapid prototyping during development phases.

Content
The increase in creativity and the strength of innovation for the planning and development of new products has become a key factor for the competitiveness of the industry. Shorter innovation cycles, an overwhelming flood of information and an increasing demand for information and communication makes the use of computer absolutely necessary. Against this background this lecture discusses the success factors for new products, and introduces a product innovation process in conjunction with planning of new products based on the concepts of system engineering. In the following the methodological assistance to this process is being discussed by introducing innovation management, idea management, problem solving strategies, creativity and rapid prototyping for instance.

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Literature
Handouts during lecture

Course: Law Aspects of Guided Transport Systems [6234903]

Coordinators: N. N.
Part of the modules: Track Guided Transport Systems / Engineering (p. 138)[WI4INGBGU27], Project in Public Transportation (p. 136)[WI4INGBGU25], Public Transportation Operations (p. 137)[WI4INGBGU26]

ECTS Credits	Hours per week	Type	Term	Instruction language
1,5	1	lecture	Winter term	de

Learning Control / Examinations
The assessment will consist of a oral exam (10 min) according to §4 (2), 1 of the examination regulation.
The exam is offered each semester. The re-examination is offered upon prior agreement with the interested participants and not later than the next regular examination date.

Conditions
See module description.

Learning Outcomes
See German version.

Content
Judical basics, law in european and national rail transportation, federal state law in public transport

Workload
The total workload for this course is approximately 45.0 hours. For further information see German version.

Literature
Elective literature:
Kunz (Hrsg): Eisenbahnrecht, Nomos-Verlag, Baden-Baden

Remarks
See German version.

Course: Recommender Systems [2540506]

Coordinators: A. Geyer-Schulz, A. Sonnenbichler
Part of the modules: Advanced CRM (p. 37)[WI4BWLISM1], Business & Service Engineering (p. 42)[WI4BWLISM4]

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

Learning Control / Examinations
Assessment consists of a written exam of 1 hour length following §4 (2), 1 of the examination regulation and by submitting written papers as part of the exercise following §4 (2), 3 of the examination regulation.
The course is considered successfully taken, if at least 50 out of 100 points are acquired in the written exam. In this case, all additional points (up to 10) from excersise work will be added. The grades of this lecture are assigned following the table below:

Grade	Minimum points
1.0	95
1.3	90
1.7	85
2.0	80
2.3	75
2.7	70
3.0	65
3.3	60
3.7	55
4.0	50
5.0	0

Conditions
None.

Learning Outcomes
The student

- is proficient in different statistical, data-mining, and game theory methods of computing implicit and explicit recommendations
- evaluates recommender systems and compares these with related services

Content
At first, an overview of general aspects and concepts of recommender systems and its relevance for service providers and customers is given. Next, different categories of recommender systems are discussed. This includes explicit recommendations like customer reviews as well as implicit services based on behavioral data. Furthermore, the course gives a detailed view of the current research on recommender systems at the Chair of Information Services and Electronic Markets.

Workload
The total workload for this lecture will amount to approximately 135 hours (4.5 credits).
\begin{tabular}{lcr}
\hline
\textbf{Activity} & & \textbf{Workload} \\
\hline
Attendance time & & \\
Attendance of lecture & 15 x 90min & 22h 30m \\
Attendance of exercise & 7 x 90min & 10h 30m \\
\hline
Self-study & & \\
Preparation of lecture & & 22h 30m \\
Wrap-up of lecture & & 22h 30m \\
Preparation of excercise& & 25h 00m \\
Preparation of assessment & & 31h 00m \\
\hline
Assessment & & 1h 00m \\
\hline
\hline
Sum & & 135h 00m \\
\end{tabular}

Media
Folien, Aufzeichnung der Vorlesung im Internet.

Literature
Rakesh Agrawal, Tomasz Imielinski, and Arun Swami. Mining association rules between sets of items in large databases. In Sushil Jajodia Peter Buneman, editor, Proceedings of the ACM SIGMOD International Conference on Management of Data, volume 22, Washington, D.C., USA, Jun 1993. ACM, ACM Press.
Rakesh Agrawal and Ramakrishnan Srikant. Fast algorithms for mining association rules. In Proceedings of the 20th Very Large Databases Conference, Santiago, Chile, pages 487 – 499, Sep 1994.
Asim Ansari, Skander Essegaier, and Rajeev Kohli. Internet recommendation systems. Journal of Marketing Research, 37:363 – 375, Aug 2000.
Christopher Avery, Paul Resnick, and Richard Zweckhauser. The market for evaluations. American Economic Review, 89(3):564 – 584, 1999.
Ibrahim Cingil, Asuman Dogac, and Ayca Azgin. A Broader Approach to Personalization. Communications of the ACM, 43(8):136 – 141, Aug 2000.
Richard O. Duda, Peter E. Hart, and David G. Stork. Pattern Classification. Wiley-Interscience, New York, 2 edition, 2001.
Andreas Geyer-Schulz, Michael Hahsler, and Maximilian Jahn. A customer purchase incidence model applied to recommender services. In R. Kohavi et al., editor, Proceedings of the WebKDD 2001 – Mining log data across all customer touchpoints, volume 2356 of Lecture Notes in Artificial Intelligence LNAI, pages 25–47, Berlin, 2002. ACM, Springer-Verlag.
Jon M. Kleinberg. Authoritative sources in a hyperlinked environment. JACM, 46(5):604–632, sep 1999.
Joseph Konstan, Bradley Miller, David Maltz, Jonathan Herlocker, Lee Gordon, and John Riedl. Grouplens: Applying Collaborative Filtering to Usernet News. Communications of the ACM, 40(3):77 – 87, Mar 1997.
Paul Resnick, Neophytos Iacovou, Peter Bergstrom, and John Riedl. Grouplens: An open architecture for collaborative filtering of netnews. In Proceedings of the conference on Computer supported cooperative work, pages 175 – 186. ACM Press, 1994.
Elective literature:
Antoinette Alexander. The return of hardware: A necessary evil? Accounting Technology, 15(8):46 – 49, Sep 1999.
Christopher Avery and Richard Zeckhauser. Recommender systems for evaluating computer messages. Communications of the ACM, 40(3):88 – 89, Mar 1997.
Steven Bellman, Gerald Lohse, and Eric Johnson. Predictors of Online Buying Behavior. Communications of the ACM, 42(12):32 – 38, Dec 1999.
Thomas J. Blischok. Every transaction tells a story. Chain Store Age Executive with Shopping Center Age, 71(3):50–56, Mar 1995.
Hans Hermann Bock. Automatische Klassifikation. Vandenhoeck und Ruprecht, Göttingen, 1974.
Andrew S.C. Ehrenberg. Repeat-Buying: Facts, Theory and Applications. Charles Griffin & Company Ltd, London, 2 edition, 1988.
Wolfgang Gaul, Andreas Geyer-Schulz, Michael Hahsler, and Lars Schmidt-Thieme. eMarketing mittels Recommendersystemen. Marketing ZFP, 24:47 – 55, 2002.
Andreas Geyer-Schulz, Michael Hahsler, and Maximilian Jahn. myvu: a next generation recommender system based on observed consumer behavior and interactive evolutionary algorithms. In W. Gaul, O. Opitz, and M. Schader, editors, Data Analysis – Scientific Modeling and Practical Applications, volume 18 of Studies in Classification, Data Analysis and Knowledge Organization, pages 447 – 457, Heidelberg, Germany, 2000. Springer.
Andreas Geyer-Schulz, Michael Hahsler, and Maximillian Jahn. Educational and scientific recommender systems: Designing the information channels of the virtual university. International Journal of Engineering Education, 17(2):153 – 163, 2001.
Mark-Edward Grey. Recommendersysteme auf Basis linearer Regression, 2004.
John A. Hartigan. Clustering Algorithms. John Wiley and Sons, New York, 1975.
Kevin Kelly. New Rules for the New Economy: 10 Radical Strategies for a Connected World. Viking, 1998.
Taek-Hun Kim, Young-Suk Ryu, Seok-In Park, and Sung-Bong Yang. An improved recommendation algorithm in collaborative filtering. In K. Bauknecht, A. Min Tjoa, and G. Quirchmayr, editors, E-Commerce and Web Technologies, Third International Conference, Aix-en-Provence, France, volume 2455 of Lecture Notes in Computer Science, pages 254–261, Berlin, Sep 2002. Springer-Verlag.
Ron Kohavi, Brij Masand, Myra Spiliopoulou, and Jaideep Srivastava. Web mining. Data Mining and Knowledge Discovery, 6:5 – 8, 2002.
G. S. Maddala. Introduction to Econometrics. John Wiley, Chichester, 3 edition, 2001.
Andreas Mild and Martin Natter. Collaborative filtering or regression models for Internet recommendation systems? Journal of Targeting, Measurement and Analysis for Marketing, 10(4):304 – 313, Jan 2002.
Andreas Mild and Thomas Reutterer. An improved collaborative filtering approach for predicting cross-category purchases based on binary market basket data. Journal of Retailing & Consumer Services, 10(3):123–133, may 2003.
Paul Resnick and Hal R. Varian. Recommender Systems. Communications of the ACM, 40(3):56 – 58, Mar 1997.
Badrul M. Sarwar, Joseph A. Konstan, Al Borchers, Jon Herlocker, Brad Miller, and John Riedl. Using filtering agents to improve prediction quality in the grouplens research collaborative filtering system. In Proceedings of ACM Conference on Computer-Supported Cooperative Work, Social Filtering, Social Influences, pages 345 – 354, New York, 1998. ACM Press.
J. Ben Schafer, Joseph Konstan, and Jon Riedl. Recommender Systems in E-commerce. In Proceedings of the 1st ACM conference on Electronic commerce, pages 158 – 166, Denver, Colorado, USA, Nov 1999. ACM.

Upendra Shardanand and Patti Maes. Social information filtering: Algorithms for automating "word of mouth". In Proceedings of ACM SIGCHI, volume 1 of Papers: Using the Information of Others, pages 210 – 217. ACM, 1995.

Remarks

As of summer term 2014 this lecture is hold in alternation with the lecture "2540533 - Personalization and Services". The current schedule can be seen on the chair's website (http://www.em.uni-karlsruhe.de/studies/).

Course: Corporate Compliance [2400087]

Coordinators: T. Dreier, N.N.
Part of the modules: Governance, Risk & Compliance (p. 155)[WI4JURGRC]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	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
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
slides

Literature
Tba at the beginning of he course.

Course: Control of Linear Multivariable Systems [23177]

Coordinators: M. Kluwe
Part of the modules: Control Engineering II (p. 139)[WI4INGETIT2]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	3/1	lecture + exercise	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam (120 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.

Recommendations
For this module a basic knowledge in system theory and control engineering is assumed. These subjects can be found for example in the course 23155 *System Dynamics and Control Engineering*, which is recommended to have been attended beforehand.

Learning Outcomes
The Students have acquired fundamental knowledge about the description of linear multivariable systems with both time continuous and time discrete models. They are able to analyze those systems with regard to their fundamental characteristics like stability, controllability, observability and pole/zero-constellation. The students are proficient in the basic principles of control design in state space and they are able to design state observers if necessary. Furthermore they are familiar with some advanced control methods allowing special demands like decoupling or robustness in spite of given boundary conditions like continuous disturbances or restricted measurements and actuators.

Content

- *Modelling of linear and time-invariant Multivariable systems*
  Input-output-models in frequency domain, time continous and time discrete state space models;
- *Analyses of linear and time-invariant Multivariable systems*
  State transformations, stability, controllability and observability, poles and zeroes;
- *Control of linear and time-invariant Multivariable systems*
  Control of input-output models in frequency domain (decoupling control), control of time continous and time discrete state space models (basic structure with steady state filter and state feedback, basic principle of pole placement, selective design methods: modal control, decoupling control, Vollständige Modale Synthese, dead beat state space control);
- *Synthesis of state space observers* Luenberger observer, reduced observer;
- *Synthesis of output feedback controllers;* S*ynthesis of controllers for long term disturbances*; disturbance control, use of disturbance models, PI state space controller;
- *Synthesis of output feedback controllers*
- *Synthesis of dynamic state space controllers*
- *Synthesis of robust controllers by pole area placement*
  definition and pole-area stability, pole area placement via Konigorski, design of robust output feedback;
- *Reduction of the order of high-order models*
  task and principles, modal reduction of order, construction of the reduced model via Litz

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

Media
Supplemental sheets
Demonstration with Matlab/Simulink

Literature
Föllinger, Otto: Regelungstechnik, Hüthig-Verlag, 8. Auflage
Elective literature:

- Lunze, Jan: Regelungstechnik 2, Springer-Verlag, 1997
- Föllinger, O.: Regelungstechnik. 10. Auflage, Hüthig Verlag, 2008

Course: Regulatory Management and Grid Management - Economic Efficiency of Network Operation [2540494]

Coordinators: S. Rogat
Part of the modules: Market Engineering (p. 41)[WI4BWLISM3]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise	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 is offered every semester. Re-examinations are offered on every ordinary examination date.

Conditions
None.

Learning Outcomes
The Student

- understands the business model of a Network Operator, his fundamental tasks and related processes,
- learns to overlook the whole complexity of network operation,
- understands the respective economic and regulatory interdependencies,
- is able to perform network relevant calculations and to prepare business decisions by well-founded analyses,
- in particular, has a sound understanding of the prevailing model of the current Incentive Regulation systems,
- understands its essential components and their impact on management decisions and economic success,
- is able to analyze controversial topics from the perspective of different stakeholders.

Content
The lecture focuses on the network operation context and the regulatory situation in Germany. Their involvement in the context of European energy politics and regulation is taken into account. The focus lies on electricity and gas networks, at all levels of voltage or pressure. The particularities of transmission grids and transmission system operators (TSOs), as opposed to distribution grids and distribution system operators (DSOs), are also taken into consideration. The selection of contents in detail – given the time restraints of lecture - follows the principle of relevance.

Workload
The total workload for this course is approximately 135 hours (4,5 Credits).
Lecture: 30 hours
Preparation of lecture: 105 hours

Media
Slides

Literature
Pérez-Arriaga, I.J.(Editor): Regulation of the Power Sector, chapters 4,5,6,14, Springer Verlag, 2013.
Bundesnetzagentur: Evaluierungsbericht nach § 33 Anreizregulierungsverordnung, Januar 2015,http://www.bmwi.de/BMWi/Redaktion/PDF/
evaluierungsbericht,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf
Bundesnetzagentur: Bericht der Bundesnetzagentur nach § 112a EnWG zur Einführung der Anreizregulierung nach § 21a EnWG, Juni 2006,
http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Energie/Unternehmen_Institutionen/Netzentgelte/Anreizregulie

Remarks
New course starting winter term 2015/2016

Course: Regulation Theory and Practice [2560234]

Coordinators: K. Mitusch
Part of the modules: Energy Economics and Energy Markets (p. 49)[WI4BWLIIP4], Network Economics (p. 65)[WI4VWL4]

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

Learning Control / Examinations
Result of success is made by a 60 minutes written examination during the semester break (according to §4(2), 1 ERSC). Examination is offered every semester and can be retried at any regular examination date.

Conditions
May not be examined, when te examination of *Regulation* [26026] was already taken.

Recommendations
Basic knowledge and skills of microeconomics from undergraduate studies (bachelor's degree) are expected.
Particularly helpful but not necessary: Industrial Economics and Principal-Agent- or Contract theories. Prior attendance of the lecture *Competition in Networks* [26240] is helpful in any case but not considered a formal precondition.

Learning Outcomes
Students

- will learn the basic aims and possibilities as well as the problems and limits of regulation
- will achieve an understanding of regulation as an incentive system under severe problems of asymmetric information and corporate governance
- will be able to apply general formal methods to the practice of regulation.

The lecture is suited for all students who want to work in companies of the network sectors – or who would like to become active on the side of regulators or in the respective political areas

Content
In network industries – like transport, utilities or communication – the forces of competition often fail in certain critical areas, so that monopolies will arise. In these cases the usual competition laws often turn out to be insufficient. Then they are complemented by special regulation laws. Accordingly, the regulation authority (in Germany the federal network agency, Bundesnetzagentur) is in charge for network industries side by side with the Federal Cartel Office as another supervisory authority. The lecture begins with a short description about the history of regulation and its relation to competition policies. Then it turns to the aims, the possibilities and the practice of regulation which are presented and analyzed critically. This happens from both a theoretical (microeconomic modelling) perspective as well as from a practical perspective with the help of various examples.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Literature and lecture notes are handed out during the course.

Course: Replication processes in micro system technologies [2143893]

Coordinators: M. Worgull
Part of the modules: Microfabrication (p. 118)[WI4INGMBIMT2], BioMEMS (p. 116)[WI4INGMBIMT1]

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

Learning Control / Examinations
The assessment will consist of a oral exam (30 min) (following §4 (2), 2 of the examination regulation).

Conditions
None.

Recommendations
This Lecture can be combined with “Chemical, physical and material science aspects of plastics in the micro technology” [2143500]
Intermediate examination or bachelor degree of mach/wing necessary.
Basic knowledge of the micro-system technology (but not a requirement) and interdisciplinary interest are favourable.

Learning Outcomes
The students will get an overview over the replication technologies with focus on the replication of microscopic parts.
The students will finally having an expertise to compare the different processes based on scientific and technical items. This includes also aspects of

- quality of the moulded parts,
- material properties,
- technologies,
- mould design,
- cost efficiency.

Content
Replication – Introduction and overview

- Diversity of replication
- Histroric examples of (micro)replication .
- Materials for replication
- Overview of replication processes – content of the lesson

Polymers – Properties and their theoretical description

- Classification of polymers
- Mechanical and thermal behaviour
- Rheologic behaviour of polymer melts
- Measurement of thermal behaviour
- Viscoelasticity – fundamentals

Mikrostructured mould inserts

- Requirements on mould inserts
- Fabrication technologies
- Electroplating of mould inserts
- Materials for moud inserts
- Mould design

Replication processes - Processes and techniques

- Overview and characteristics
- Micro injection moulding
- Injection compression moulding
- Reaction injection moulding

- Thermoforming
- Hot embossing
- Comparision of processes
- Nanoimprinting

Characterisation of replicated parts

- Quality criteria
- Lateral precision
- Quality of surfaces
- Classification of cases of damage

Process simulation (Hot embossing)

- General aspects of process simulation
- Analytic model
- FEM – Basic aspects
- Simulation of a hot embossing cycle
- Excursion to labs in Campus Nord

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Printouts of the lecture presentation, if applicable further scientific articles.

Course: Product Design [22215]

Coordinators: Schuchmann
Part of the modules: Specialization in Food Process Engineering (p. 145)[WI4INGCV4]

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

Learning Control / Examinations
See module description.

Conditions
None.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Course: Risk Communication [2530395]

Coordinators: U. Werner
Part of the modules: Insurance Management II (p. 32)[WI4BWLFBV7], Insurance Management I (p. 31)[WI4BWLFBV6]

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

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Elective literature:
R. Löfstedt, L. Frewer (Hrsg.). The Earthscan Reader in Risk & Modern Society. London 1998.
B.-M. Drottz-Sjöberg. Current Trends in Risk Communication - Theory and Practice. Hrsg. v. Directorate for Civil Defence and Emergency Planning. Norway 2003.
Munich Re. Risikokommunikation. Was passiert, wenn was passiert? www.munichre.com
O.-P. Obermeier. Die Kunst der Risikokommunikation - Über Risiko, Kommunikation und Themenmanagement. München 1999.
Fallstudien unter www.krisennavigator.de

Course: Risk Management in Industrial Supply Networks [2581992]

Coordinators: M. Wiens
Part of the modules: Industrial Production III (p. 47)[WI4BWLIIP6]

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

Learning Control / Examinations
The assessment consists of an oral (30 minutes) or a written (60 minutes) exam (following § 4(2), 1 of the examination regulation). The exam takes place in every semester. Reexaminations are offered at every ordinary examination date.

Conditions
None.

Learning Outcomes
Students shall learn methods and tools to manage risks in complex and dynamically evolving supply chain networks. Students learn the characteristics of modern logistics and supply chain management including trends such as globalization, lean production and e-business and learn to identify and analyze the arising risks. On the basis of this overview on supply chain management, the students gain knowledge about approaches and methods of industrial risk management. These approaches will be adapted to answer the specific questions arising in supply chain management. Key aspects include the identification of major risks, which provide the basis for the development of robust networks, and the design of strategic and tactic risk prevention and mitigation measures. In this manner, students will gain knowledge in designing and steering of robust internal and external value-creating networks.

Content

- supply chain management: introduction, aims and trends
- industrial risk management
- definition und characterization of risks: sourcing and procurement, demand, production and infrastructure
- identification of risks
- risk controlling
- risk assessment and decision support tools
- risk prevention and mitigation strategies
- robust design of supply chain networks
- supplier selection
- capacity management
- business continuity management

Workload
The total workload for this course is approximately 105 hours. For further information see German version.

Media
Media will be provided on the e-learning plattform.

Literature
will be announced in the course

Course: Roadmapping [2545016]

Coordinators: D. Koch
Part of the modules: Entrepreneurship (EnTechnon) (p. 57)[WI4BWLENT1], Innovation Management (p. 58)[WI4BWLENT2]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar	Summer term	de

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Recommendations
Prior attendance of the course *Innovation Management* [2545015] is recommended.

Learning Outcomes
Students develop a differentiated understanding of Roadmapping by working on different thematic aspects linked with the roadmapping method and by actively participating.

Content
Roadmapping is a method used to support innovation decisions in the early phase of innovation management. The roadmapping process addresses the procedure of constructing roadmaps which can then be assessed. Roadmapping provides structured and graphical visualizations of preferably future-oriented topics which have innovation potentials. The benefits of the roadmapping method lie in the structured bundling of both technology- and market-driven individual topics and the joint setting of priorities and processes to achieve predetermined corporate targets. As a rule, roadmaps represent a consensus reached by the people involved in their compilation. For this reason, roadmaps are suited to the designation and initial prioritization of emerging technologies and corresponding development projects.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Slides.

Course: Sales Management and Retailing [2572156]

Coordinators: M. Klarmann
Part of the modules: Sales Management (p. 53)[WI4BWLMAR6]

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

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

Conditions
This course is compulsory within the module "Sales Management" and must be passed. This rule only applies to students who take the first examination within the module "Sales Management" after 01.12.2015.

Learning Outcomes
Students
- know challenges regarding the organization of distribution systems
- have knowledge in the field of forecasting and are able to predict the expected sales with the help of different approaches (e.g. exponential smoothing and moving averages)
- are able to plan and to put into practice customer satisfaction measurements
- know the main goals of customer relationship management and are able to implement them with the suitable instruments (e.g. loyalty programs, cross selling and customers-recruit-customers programs)
- are capable to put customer prioritization into place and to calculate the customer lifetime value
- know and have mastered the processes to generate recommendations (e.g. collaborative filtering process and affinity analysis)
- have well-founded knowledge of complaint management and customer recovery)
- understand the transaction cost theory and know its meaning in practice
- know different kinds of sales channels and can analyze their success
- are aware of power sources and conflicts between producer and retailer and can use this knowledge for a successful vertical marketing
- know the particularities of trade marketing regarding the components of the extended marketing mix
- have well-founded knowledge of quantitative determining of retail prices

Content
The aim of the course "Sales Management and Retailing" is on the one hand to give insights into the challenging realization of a successful sales management and on the other hand to discuss peculiarities of retailing contexts. The contents are below others:

- Customer relationship management (word-of-mouth-analysis, key account management, loyalty programs, complain management etc.)
- Retail marketing (trends, point of sale design etc.)
- Retailer-producer relationships

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Remarks
For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).
This course is held in English.

Course: Key qualifications ZAK [SQ ZAK1]

Coordinators: ZAK
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
1-3	k.A.	seminar	Winter / Summer Term	de

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
Learning targets can be divided into three main categories which complement each other. Learning targets for the respective courses are defined in the course description of each course
1. Orientative Knowledge

- Students understand how their subjective position is rooted in their cultural background and they are enabled to consider the point of view and interests of others (by transgressing academic, cultural and language boundaries)
- They gain insights into other academic disciplines and apply these insights by working together with students of various academic backgrounds in interdisciplinary course.
- They expand their skills to participate in scientific or public discussions in an appropriate and adequate way.

2. Applied studies

- Students acquire insights into the routines of professional work.
- They develop individual learning skills.
- They develop smaller projects under supervision of their teacher that can be realized (i.e. in the area of radio KIT or film studies)
- They can apply basic questions and methods of the cultural sciences to their own fields of experience.

3. Basic skills

- Students can acquire new knowledge independently in a planned, goal-oriented and methodologically well-founded way. They can apply these skills to the solution of tasks and problems.
- They dispose of efficient working methods, prioritize, take decisions and assume responsibilities.
- They learn how to work in a team and are able to reflect team processes.
- They develop intercultural competences and apply those to team projects.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Welding Technology I/II [21565/21570]

Coordinators: Spies
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2	lecture	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists of an oral exam (40 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation).

Conditions
basics of material science (iron- and non-iron alloys), of electrical engineering, of production processes.

Learning Outcomes

- knowledge and understanding of the most important welding processes and its industrial application.
- recognition, understanding and handling of problems occuring during the application of different welding processes relating to design, material and production.
- classification and importance of welding technonolgy within the scope of connecting processes (advantages/disadvantages, alternatives).
- recognition, understanding and handling of problems occuring during the application of different welding processes relating to design, material and production.
- consolidation of knowledge of material behaviour during welding
- design and properties of welded constructions
- quality assurance for welding processes

Content
Welding Technologies I

- definition, application and differentiation: welding, welding processes, alternative connecting technologies.
- history of welding technology
- sources of energy for welding processes
- Survey: fusion welding, pressure welding.
- seam preparation/design
- welding positions
- weldability
- gas welding, thermal cutting
- manual metal-arc welding
- submerged arc welding
- IV characteristics: arc/sources of energy
- gas-shielded metal-arc welding

Welding Technologies II

- narrow gap welding
- TIG-welding
- plasma arc welding
- electron beam welding
- laser welding
- spot welding / projection welding
- heat flow at welding
- welding of low-alloy steel / time-temperature-transformation curve.
- welding of high-alloy steel / austenite / Schaefflerdiagramm
- low temperature steels

- welding of cast iron
- heat treatment for welding
- welding of aluminium alloys
- residual welding stress
- methods of testing
- design of welded constructions

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Literature
Elective literature:

- Ruge: Handbuch der Schweißtechnik, Springer-Verlag, 1985
- Dilthey: Schweißtechnische Fertigungsverfahren I, Augustinus, Aachen, 1991
- Fachbände des Deutschen Verlags für Schweißtechnik

Course: Academic learning [SQ HoC1]

Coordinators: HoC
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
2-3	meist 2	seminar	Winter / Summer Term	de

Learning Control / Examinations
See German version.

Conditions
See German version.

Recommendations
None.

Learning Outcomes
See German version.

Content
See German version.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Presentation and communication skills [SQ HoC2]

Coordinators: HoC
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
2-3	meist 2	seminar	Winter / Summer Term	de

Learning Control / Examinations
See German version.

Conditions
See German version.

Recommendations
None.

Learning Outcomes
See German version.

Content
See German version.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Working methodically [SQ HoC3]

Coordinators: HoC
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
2-3	meist 2	seminar	Winter / Summer Term	de

Learning Control / Examinations
See German version.

Conditions
See German version.

Recommendations
None.

Learning Outcomes
See German version.

Content
See German version.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Scientific writing [SQ HoC4]

Coordinators: HoC
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
2-3	k.A.	seminar	Winter / Summer Term	de

Learning Control / Examinations
See German version.

Conditions
See German version.

Recommendations
None.

Learning Outcomes
See German version.

Content
See German version.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Business in focus [SQ HoC5]

Coordinators: HoC
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
2-3	k.A.	seminar	Winter / Summer Term	de

Learning Control / Examinations
See German version.

Conditions
See German version.

Recommendations
None.

Learning Outcomes
See German version.

Content
See German version.

Workload
The total workload for this course is approximately -88 hours. For further information see German version.

Course: Semantic Web Technologies [2511310]

Coordinators: R. Studer, A. Harth
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Summer term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following §4, Abs. 2, 1 of the examination regulation or of an oral exam (20 min) following §4, Abs. 2, 2 of the examination regulation.
The exam takes place every semester and can be repeated at every regular examination date.

Conditions
Lectures on Informatics of the Bachelor on Information Management (Semester 1-4) or equivalent are required.

Recommendations
None.

Learning Outcomes
The student

- understands the motivation and foundational ideas behind Semantic Web and Linked Data technologies, and is able to analyse and realise systems
- demonstrates basic competency in the areas of data and system integration on the web
- masters advanced knowledge representation scenarios involving ontologies

Content
"Semantic Web" denotes an extension of the World Wide Web with meta data and applications to make the meaning (semantics) of data on the web usable in intelligent systems, e.g. in e-commerce and internet portals.
Central concepts are the representation and processing of knowledge in form of ontologies and the access via Linked Data. This lecture provides the foundations of knowledge representation and processing for the corresponding technologies and presents example applications.
The following topics are covered:

- Resource Description Framework (RDF) and RDF Schema (RDFS)
- Web Architecture and Linked Data
- Web Ontology Language (OWL)
- Rule languages
- Applications

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Media
Lecture notes.

Literature
See German version.

Remarks
The lecture supersedes the existing SWT-1 and SWT-2 lectures beginning from SS 2014. The exams SWT-1 and SWT-2 will be offered latest until winter term 2014/15.

Course: Applied Econometrics [semSTAT1]

Coordinators: M. Schienle
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
The assessment is done according to §4(2), 3 of the examination regulation.
Students write a seminar paper on an assigned topic (10 to 12 pages), present it in class and discuss results during seminar sessions. These three elements are graded individually. The seminar grade is the weighted average of these individual grades. The weighting depends on the respective seminar.

Conditions
None.

Learning Outcomes

Content

Workload
The total workload for this course is approximately 90 hours.
Lecture 30h
Preparation of lecture 45h
Exam preparation 15h

Course: Seminar in Enterprise Information Systems [SemAIFB1]

Coordinators: R. Studer, A. Oberweis, T. Wolf, R. Kneuper
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar	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 and a presentation.
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.
The seminar is for bachelor as well as master students. The differentiation will be made by selection of different topics and different standards of evaluation.

Conditions
See corresponding module information.

Learning Outcomes
Students

- do literature search based on a given topic, identify relevant literature and evaluate this literature,
- give presentations in a scientific context in front of an auditorium to present the results of the research,
- present results of the research in a seminar thesis as a scientific publication using format requirements such as those recommended by well-known publishers.

Content
The seminar intensifies and extends specific topis which are discussed within corresponding lectures. Knowledge of these lecture topics is an advantage but not a precondition.
Specific titles and the topics of offered seminars will be announced before the start of a semester in the internet at http://www.aifb.uni-karlsruhe.de/Lehre

Workload

Literature
Literature will be given individually in the specific seminar.

Course: Seminar Data Mining I [2521388]

Coordinators: G. Nakhaeizadeh
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
The assessment is done according to §4(2), 3 of the examination regulation.
Students write a seminar paper on an assigned topic (10 to 12 pages), present it in class and discuss results during seminar sessions. These three elements are graded individually. The seminar grade is the weighted average of these individual grades. The weighting depends on the respective seminar.

Conditions
None.

Learning Outcomes

Content

Workload
The total workload for this course is approximately 90 hours.
Lecture 30h
Preparation of lecture 45h
Exam preparation 15h

Course: Seminar Data Mining II [2520375]

Coordinators: G. Nakhaeizadeh
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar	Summer term	

Learning Control / Examinations
The assessment is done according to §4(2), 3 of the examination regulation.
Students write a seminar paper on an assigned topic (10 to 12 pages), present it in class and discuss results during seminar sessions. These three elements are graded individually. The seminar grade is the weighted average of these individual grades. The weighting depends on the respective seminar.

Conditions
None.

Learning Outcomes

Content

Workload
The total workload for this course is approximately 90 hours.
Lecture 30h
Preparation of lecture 45h
Exam preparation 15h

Course: Seminar Efficient Algorithms [SemAIFB2]

Coordinators: H. Schmeck
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar	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

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

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 Energy Economics [SemEW]

Coordinators: W. Fichtner, P. Jochem, D. Keles, R. McKenna, V. Bertsch
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
Students shall gain insights into selected research in energy economics.
• Students search for, identify, review and evaluate relevant literature.
• Students prepare their seminar thesis (and later on bachelor/master thesis) with a minimum expense in becoming acquainted with their topic and general layout.
• Students produce an oral presentation in a scientific context by using the outlined techniques of scientific presentation.
• Students learn to present their written results in an adequate form for scientific publishing.
Students in M.Sc. studies will have to put special emphasis on a critical discussion and evaluation of their topic, since they will have to look into actual scientific results in the field of energy economics.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Seminar Public Finance [2560130]

Coordinators: B. Wigger, Assistenten
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations

Conditions
See module description.
Adequate for students in an advanced stage of their studies.

Learning Outcomes
See German version.

Content
Preparation, presentation, and discussion of recent research papers on varying Public Finance issues. The current seminar subject, including the exact topics to work on, will be announced under http://fiwi.iww.kit.edu and on the notice board prior to the start of semester.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Will be announced at the beginning of the seminar.

Course: Seminar Conveying Technology and Logistics [SemIFL]

Coordinators: K. Furmans
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
Participation during the information presentation. The performance review is based on the written paper and the two presentations. Active participation during the presentations is required.

Conditions
See module.

Recommendations
See German version.

Learning Outcomes
Students are able to work on scientific subjects under guidance, which includes:

- the self driven outline of the inquired subject,
- investigating and argumenting in the context of logistics and material handling,
- the presentation of the results in front of professionals and
- the written work.

Thereby presentation technique is used and enlarged.

Content
The topics of the seminar will be published under http://www.ifl.kit.edu/seminare.php one semester before. To participate it is necessary to sign in the semester before.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Entrepreneurship Seminar [SemTuE1]

Coordinators: O. Terzidis
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
3		seminar		

Learning Control / Examinations
See German version.

Conditions
None.

Learning Outcomes
The scope is depending on the seminars summarised hereunder.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Seminar Innovation management [SemTuE2]

Coordinators: M. Weissenberger-Eibl
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
3		seminar		

Learning Control / Examinations
See German version.

Conditions
None.

Learning Outcomes
Students develop a differentiated understanding of a specific method of innovation management and its application by actively participating in the block seminar.

Content
The objective of the seminar is to master selected concepts and methods of innovation management and then to apply these practically. Working in groups, the students apply the described concepts and methods of innovation management to a case study to answer specific questions. Accordingly, the block seminar involves a switch from input to the application of this input. At the end, the results of the group work are presented in the form of a seminar paper and discussed by the whole course. A short introduction to presentation techniques is planned to help students prepare the seminar papers.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Seminar Water Quality [6223813]

Coordinators: S. Fuchs, U. Mohrlok
Part of the modules: Environmental Management (p. 132)[WI4INGBGU14]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar	Summer term	de

Learning Control / Examinations
The assessment consists of an oral exam (30 minutes) (following §4(2), 2 of the examination regulation) and an non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
none

Recommendations
Attendance to the course Siedlungswasserwirtschaft [6200603] is recommended.

Learning Outcomes
Die students are able to explain and evaluate critically the interdisciplinary interrelations (fluid mechanics, chemistry, ecology) which determines the water quality in surface water and groundwater by means of presenting the theoretical basics and the legal framework.

Content

- Basics: fluid mechanics, mass balances, zonation
- Water Framework Directive, Water Management Act, Soil Protection Act
- pollution of water bodies: inflows, contaminant pollution (geogenic, anthropogenic)
- sediment problems in large regulated rivers: sediment transport, contaminant load of river sediments, formation of green house gases
- methods for the evaluation of water quality and sate of water body: biological, chemical, structural

Workload
The total workload for this course is approximately 90.0 hours. For further information see German version.

Literature
Schwörbel, J. & Brendelberger, H. (2005): Einführung in die Limnologie. 9. Auflage, Spektrum Akademischer Verlag.
Lampert, W. & Sommer, U. (1999): Limnoökologie. 2. Auflage, Georg Thieme Verlag, Stuttgart.
Schwörbel, J. (1994): Methoden der Hydrobiologie: Süßwasserökologie. 4. Auflage, UTB-Verlag Gustav Fischer, Stuttgart.
DIN 38410 (2004): Deutsche Einheitsverfahren zur Wasser-, Abwasser- und Schlammuntersuchung – Biologisch-ökologisch Gewässeruntersuchung. DIN Deutsches Institut für Normung e.V., Beuth Verlag, Berlin.
DVWK (Deutscher Verband für Wasserwirtschaft und Kulturbau), Schriften 107, „Grundwassermessgeräte", Verlag Paul Parey, 1994.
DVWK (Deutscher Verband für Wasserwirtschaft und Kulturbau), Schriften 125, "Methoden für die Beschreibung der Grundwasserbeschaffenheit", Verlag Paul Parey, 1999.
Wechselnde aktuelle Literatur.

Remarks
The course Seminar Water Quality (6223813) together with the course Field Training Water Quality (6223814) replaces the combination of the courses Surface Water Quality (6223805)/Groundwater Quality (6221811).

Course: Seminar Human Resource Management [2573011]

Coordinators: P. Nieken
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
The assessment is done according to §4(2), 3 of the examination regulation.
Students write a seminar paper on an assigned topic (10 to 12 pages), present it in class and discuss results during seminar sessions. These three elements are graded individually. The seminar grade is the weighted average of these individual grades. The weighting depends on the respective seminar.

Conditions
None.

Learning Outcomes
The student

- looks critically into current research topics in the fields of Human Resource Management and Personnel Economics.
- trains his / her presentation skills.
- learns to get his / her ideas and insights across in a focused and concise way, both in oral and written form, and to sum up the crucial facts.
- cultivates the discussion of research approaches.

Content
The topics are redefined each semester on basis of current research topics. The topics will be announced on the website of the Chair.

Workload
The total workload for this course is approximately 90 hours.
Lecture 30h
Preparation of lecture 45h
Exam preparation 15h

Literature
Selected journal articles and books.

Remarks
This course has been added summer 2015.

Course: Seminar in Behavioral and Experimental Economics [n.n.]

Coordinators: P. Reiss
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
Students write (according to Section 4 (2), 3 SPO) a seminar paper on an assigned topic (15-20 pages), present it in class and discuss results during seminar sessions. These three elements are graded individually. The seminar grade is the weighted average of these individual grades where the weighting is announced on the course syllabus.

Conditions
None.

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

Learning Outcomes
The student

- works independently on a topic in Experimental Economics and/or Behavioral Economics,
- writes a seminar paper according to scientific standards,
- gives a presentation on the results of the paper,
- cultivates the discussion of research approaches.

Content
Seminar topics are announced online at http://io.econ.kit.edu (-> Studium und Forschung).

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Slides.

Literature
A selection of published papers is compulsory reading for the course.

Remarks
Language: german or english.

Course: Seminar in Finance [2530280]

Coordinators: M. Uhrig-Homburg, M. Ruckes
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations

Conditions
None.

Recommendations
Knowledge of the content of the module *F1 (Finance)* [WI4BWLFBV1] 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.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Will be announced at the end of the foregoing semester.

Course: Seminar Financial Economics and Risk Management [2530353]

Coordinators: M. Ulrich
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
See German version.

Conditions
None.

Learning Outcomes
The students

- look critically into current research topics .
- train their presentation skills.
- learn to get their ideas across in a focused and concise way, both in oral and written form.
- cultivate the economic discussion of research approaches.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Seminar in International Economy [SemIWW2]

Coordinators: J. Kowalski
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2/0	seminar	Winter / Summer Term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes
The student gets aquianted with various modern doctrines and theories pertinent to international economic policy. They shoud understand the structure of the institutional framework relevant for the global economy and the way it functions. They should be able to form their own jugement on the strategies, measures and outcomes of actions of various actors dealing with the international economic policy.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Seminar in Marketing and Sales (Master) [SemETU2]

Coordinators: M. Klarmann, S. Feurer
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
Grading system: written seminar paper (weighting 60%), presentation of the seminar paper (weighting 30%), oral participation (weighting 10%).

Conditions
None.

Learning Outcomes
Students
- can exploit a literature field systematically
- are able to write an academic paper in a formally correct way
- can assess the relevance and quality of sources
- are able to get an overview of sources very quickly
- know how to find relevant sources for a literature field
- are capable to write a convincing outline
- know how to categorize a subject under a research field
- understand how to systematize literature fields theoretically and empirically with the help of literature tables
- can identify the most important findings in a huge number of sources
- are able to present a research field
- can discuss the theoretical and practical implications of a topic
- are capable to identify interesting research gaps

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Remarks
Students interested in master thesis positions at the chair of marketing should participate in the marketing seminar.
For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).

Course: Seminar in Economic Policy [SemIWW3]

Coordinators: I. Ott
Part of the modules: (p. 77)[WI4VWL19], Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
The assessment is carried out through a term paper within the range of 12 to 15 pages, a presentation of the results of the work in a seminar meeting, and active participation in the discussions of the seminar meeting (§ 4 (2), 3 SPO).

The final grade is composed of the weighted graded examinations. (Essay 50%, 40% oral presentation, active participation 10%).

The seminar is intended for students both of bachelor and master degree program. They are differentiated by different assessment criteria for term paper and presentation grading.

Conditions
At least one of the lectures “Theory of Endogenous Growth” or “Innovation Theory and Policy” should be attended in advance, if possible.

Learning Outcomes
Students are able to

- work on an economic policy question based the scientific literature by employing fundamental methods from economics
- conduct a thorough literature research and (if applicable) illustrate their results with e.g. Mathematica
- present their results in a term paper that satisfies the requirements of a scientific publication
- give a presentation of their results together with another participant of the seminar
- discuss the term papers and presentations of the other participants

Content
The current topic of the seminar including the subjects treated will be announced before the semester begins at http://wipo.iww.kit.edu.
Previous Topics:

- Economic Aspects of General Purpose Technologies (SS 2010)
- Questions of Modern Economic Growth Theories (WS 2010/2011)
- Beans or fully automated machines? Determinants of Developement and Growth in a globalized World (SS 2011)
- Technology Assessment and strategic Patent Analyses (WS 2011/2012)
- Innovation Potentials and Spatial Dimension in Cultural and Creative Industries (WS 2011/2012)
- Quantitative Methods in Economics with Mathematica (SS 2012)

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Seminar in Industrial Production [SemIIP2]

Coordinators: F. Schultmann, M. Fröhling
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
Assessment acc. to §4 (2), No.3 ER by assessing the written seminar thesis (approx. 20 pages), the oral presentation and active participation in public discussions. The final grade will be formed by weighing the individual assessment grades.

Conditions
Students should have completed the modules „Industrial Production I“ [WW3BWLIIP], „Industrial Production II“ [WI4BWLIIP2] or “Industrial Production III” [WW3BWLIIP6].

Learning Outcomes
Students shall gain insights into selected research of the Institute of Industrial Production (IIP).

- Students search for, identify, review and evaluate relevant literature.
- Students prepare their seminar thesis (and later on bachelor/master thesis) with a minimum expense in becoming acquainted with their topic and general layout.
- Students produce an oral presentation in a scientific context by using the outlined techniques of scientific presentation.
- Students learn to present their written results in an adequate form for scientific publishing.

Students in M.Sc. studies will have to put special emphasis on a critical discussion and evaluation of their topic, since they will have to look into actual scientific results in the field of industrial production.

Content
This seminar covers actual topics of industrial production, logistics, environmental science, project management and similar fields. We recommend a successful attendance of previous IIP modules (not compulsory!).
Actual topics covered in this seminar will be published before the start of semester.

Workload
Total effort required will sum up to approximately 90h.

Course: Seminar Information Engineering and Management [SemIW]

Coordinators: C. Weinhardt
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
The assessment consists of a seminar paper, a presentation of the results and the contribution to the discussion (according to §4(2), 3 of the examination regulation). The final grade is based on the evaluation of each component (seminar paper, oral presentation, and active participation).

Conditions
See corresponding module information.

Recommendations
At least one module offered by the institute should have been chosen before attending this seminar.

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
In the seminar the student should learn to apply the research methods to a predefined topic area. The topics are based on research questions in Information Engineering and Management across different industry sectors. This problem analysis requires a interdisciplinary examination.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media

- PowerPoint
- E-learning platform ILIAS
- Software Tools, if necessary

Literature
The student will receive the necessary literature for his research topic.

Remarks

- Students from Bachelor and Master Course can visit the seminar. The research topic as well as the evaluation of the work and the presentation will have a different focus between Bachelor and Master Course.
- All the seminars offered at the chair of Prof. Dr. Weinhardt can be chosen. The current topics of the seminars are available at the following homepage: www.iism.kit.edu/im/lehre .

Course: Seminar Management Accounting [2579904]

Coordinators: M. Wouters
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
The final grade of the course is the grade awarded to the paper.

Conditions
The LV "Betriebswirtschaftslehre: Finanzwirtschaft und Rechnungswesen" (2610026) must have been completed before starting this seminar.

Learning Outcomes
Students
• are largely independently able to identify a distinct topic in Management Accounting,
• are capable to research the topic, analyze the information, to conceptualize and deduct fundamental principles and relationships from relatively unstructured information,
• can afterwards logically and systematically present the results in writing and as an oral presentation, following a scientific approach (structuring, terminology, sources.

Content
The course will be a mix of lectures, discussions, and student presentations. Students will write a paper in small groups, and present this in the final week. You are to a large extent free to select your own topic. The seminar course is concentrated in four meetings that are spread throughout the semester.
Meeting 1: Introductory lecture. You need to conduct a first literature search and at the end of the first week you should identify (provisionally) the topic for your paper.
Meeting 2 and 3: The purpose of the second week is to define the topics and research questions in much more detail. Different types of papers may be selected: literature review, research paper, descriptive case study, or teaching case. Students will present their ideas and all participants should ask questions, help each other focus, offer ideas, etc.
Meeting 4: In the third week we are going to present and discuss the final papers.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Will be announced in the course.

Remarks
Maximum of 24 students.

Course: Seminar Mobility Services [2595475]

Coordinators: G. Satzger, C. Stryja
Part of the modules: Transportation Modelling and Traffic Management (p. 134)[WI4INGBGU16], Fundamentals of Transportation (p. 133)[WI4INGBGU15], Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
A final written exam will be conducted.

Conditions
See module description.

Learning Outcomes
The student should be able to do a literature review based on a predefined topic in the context of mobility services. The approach comprises the identification of relevant literature according to the topic and an analysis as well as an evaluation of the methods presented in the literature. The student learns to present his results in a paper and in front of an audience on an academic level.

Content
The seminar gives an insight in different aspects of services in the context of mobility. Changes in business models in the mobility sector as well as the adaptation of new demand patterns for mobility play a crucial role in this context. These shifts are accompanied by a technological evolution including new mobile devices that enable dynamic and flexible access to information. In the seminar, the student should learn to apply the research methods to predefined research questions; in this context, e.g. literature reviews, structured interviews, and the comparison of business models are employed.

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Remarks
The credits for the course have been changed from 4 to 3 from summer term 2015 on.

Course: Seminar on Morals and Social Behavior [SemPÖ1]

Coordinators: N. Szech
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
Students write a seminar paper on an assigned topic (10 pages), present it in class and discuss results during seminar sessions. These three elements are graded individually. The seminar grade is the weighted average of these individual grades where the weighting is announced on the course syllabus.

Conditions
None.

Recommendations
None.

Learning Outcomes
The students

- look critically into current research topics in the field of morals and social behavior in relevant economic contexts.
- train their presentation skills.
- learn to get their ideas across in a focused and concise way, both in oral and written form.
- cultivate the economic discussion of research approaches.

Content
Seminar topics are announced online at http://polit.econ.kit.edu.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
A selection of published papers and books.

Remarks
The seminar will be held in English.

Course: Seminar on Topics in Experimental Economics [n.n.]

Coordinators: P. Reiss
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar	Summer term	

Learning Control / Examinations
Students write (according to Section 4 (2), 3 SPO) a seminar paper on an assigned topic (15-20 pages), present it in class and discuss results during seminar sessions. These three elements are graded individually. The seminar grade is the weighted average of these individual grades where the weighting is announced on the course syllabus.

Conditions
None.

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

Learning Outcomes
The student works independently on a topic in Experimental Economics, writes a seminar paper according to scientific standards, gives a presentation on the results of the paper, cultivates the discussion of research approaches.

Content
Seminar topics are announced online at http://io.econ.kit.edu (-> Studium und Forschung).

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Presentation Slides.

Literature
A selection of published papers is compulsory reading for the course.

Remarks
Language: German or English.

Course: Seminar on Topics in Political Economics [SemPÖ2]

Coordinators: N. Szech
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
Students write a seminar paper (about 10 pages), present it in class and discuss results during seminar sessions. These three elements are graded individually. The seminar grade is the weighted average of these individual grades where the weighting is announced on the course syllabus.

Conditions
None.

Recommendations
None.

Learning Outcomes
The students

- look critically into current research topics in Political Economics.
- train their presentation skills.
- learn to get their ideas across in a focused and concise way, both in oral and written form.
- cultivate the economic discussion of research approaches.

Content
Seminar topics are announced online athttp://polit.econ.kit.edu

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
A selection of published papers and books.

Remarks
The seminar will be held in English.

Course: Seminar Human Resources and Organizations [2573010]

Coordinators: P. Nieken
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
The assessment is done according to §4(2), 3 of the examination regulation.
Students write a seminar paper on an assigned topic (10 to 12 pages), present it in class and discuss results during seminar sessions. These three elements are graded individually. The seminar grade is the weighted average of these individual grades. The weighting depends on the respective seminar.

Conditions
None.

Learning Outcomes
The student

- looks critically into current research topics in the fields of human resources and organizations.
- trains his / her presentation skills.
- learns to get his / her ideas and insights across in a focused and concise way, both in oral and written form, and to sum up the crucial facts.
- cultivates the discussion of research approaches.

Content
The topics are redefined each semester on basis of current research topics. The topics will be announced on the website of the Chair.

Workload
The total workload for this course is approximately 90 hours.
Lecture 30h
Preparation of lecture 45h
Exam preparation 15h

Literature
Selected journal articles and books.

Remarks
This course has been added summer 2015.

Course: Seminar Pricing [2540445]

Coordinators: J. Kim
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar	Summer term	de

Learning Control / Examinations

Conditions
None.

Recommendations
This course is for master students only.

Learning Outcomes

Content

Workload

Remarks
New master-course starting summer term 2015.

Course: Seminar Risk and Insurance Management [SemFBV1]

Coordinators: U. Werner
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
At least one oral presentation and one term paper have to be deliverd, either as individual work or as team work. Active participation in class and working groups is expected (according to §4(2), 3 SPO).
The grading consists of the weighted performance of the tasks delivered.

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* [WI4BWLFBV6] and *Insurance Management* II [WI4BWLFBV7]. These modules, though, are not required to be taken.

Learning Outcomes
See German version.

Content
The seminar is offered within the following courses:

- Principles of Insurance Management
- Insurance Marketing
- Insurance Production
- Risk Communication
- Insurance Risk Management
- Enterprise Risk Management
- Modeling, Measuring and Management of Extreme Risks
- Current Issues in the Insurance Industry

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

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Will be announced at the beginning of the lecture period.

Remarks
Some of the courses mentioned above are offered on demand. For further information, see:http://insurance.fbv.kit.edu.
To attend the course please register with the secretary of the chair: thomas.mueller3@kit.edu

Course: Seminar Service Science, Management & Engineering [2595470]

Coordinators: C. Weinhardt, R. Studer, S. Nickel, H. Fromm, W. Fichtner, G. Satzger
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
The assessment of this course is according to §4(2), 3 SPO in form of an examination of the written seminar thesis (15-20 pages), a presentation and active participation in class.
The final mark is based on the examination of the written seminar thesis but can be upgraded or downgraded according to the quality of the presentation.

Conditions
See corresponding module information.

Recommendations
Lecture *eServices* [2595466] is recommended.

Learning Outcomes
The student

- illustrates and evaluates classic and current research questions in service science, management and engineering,
- applies models and techniques in service science, also with regard to their applicability in practical cases,
- successfully gets in touch with scientific working by an in-depth working on a special scientific topic which makes the student familiar with scientific literature research and argumentation methods,
- acquires good rhetorical and presentation skills.

As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the seminar topic.

Content
Each Semester, the seminar will cover topics from a different selected subfield of Service Science, Management & Engineering. Topics include service innovation, service economics, service computing, transformation and coordination of service value networks as well as collaboration for knowledge intensive services.
See the KSRI website for more information about this seminar: www.ksri.kit.edu

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Literature
The student will receive the necessary literature for his research topic.

Course: Seminar Statistics [SemSTAT]

Coordinators: N.N.
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar		

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Seminar Stochastic Models [SemWIOR1]

Coordinators: K. Waldmann
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
The assessment of this course is in form of an examination of the written seminar thesis and a presentation. The final mark is the result of both the paper and its presentation.

Conditions
None.

Learning Outcomes
The participants will posses profound knowledge of modelling, evaluation and optimization of stochastic systems .They are familiar with basic principles of scientific argumentation and can cope with modern presentation techniques.

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

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Power Point and related presentation techniques.

Literature
Will be presented with the actual topic.

Course: Seminar Business Ethics [SemIIP3]

Coordinators: A. Wollert
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Seminar in Transportation [6232903]

Coordinators: P. Vortisch, B. Chlond
Part of the modules: Transportation Modelling and Traffic Management (p. 134)[WI4INGBGU16], Fundamentals of Transportation (p. 133)[WI4INGBGU15]

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

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
See module description.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Seminar Knowledge Management [SemAIFB4]

Coordinators: R. Studer
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
The success monitoring is done through a presentation about a research topic from the current topic of the seminar (45-60 minutes) followed by a discussion, a written summary of the main points (approx. 15 pages) and of active participation in discussions (in accordance with §4(2),3 SPO).
The total mark is composed of the graded and weighted success controls (50% lecture, 30% written paper, and 20% participation and discussion.
The seminar can be attended by both bachelor and master students. A differentiation is made by different topic assignment and evaluation standards for seminar paper and presentation.

Conditions
See module description.

Learning Outcomes
The students will learn to perform literature searches on current topics in computer science and holistic knowledge management as well as preparing and presenting the contents of scientific publications.

During the work on the seminar topics the master students will deepen their skills to autonomously comprehend current scientific knowledge and to convey it to others through oral presentations and written summaries.

Through active participation in the seminar, students acquire skills in critical appraisal of research topics and in oral and written presentation of independently developed research content.

Content
Each year, the seminar will cover topics from a different selected subfield of knowledge management, e.g.:

- Ontology-based knowledge management,
- Information Retrieval and Text Mining,
- Data Mining,
- Personal Knowledge Management,
- Case Based Reasoning (CBR),
- Collaboration and Scoial Computing,
- Business-process Oriented Knowledge Management.

Workload
The total workload for this course is approximately 120.0 hours. For further information see German version.

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 strategic and behavioral marketing [2572197]

Coordinators: B. Neibecker
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
The student is evaluated based on the written work, a presentation of the results in front of an audience and his contribution to the discussion

Conditions
None.

Learning Outcomes
Students

- do literature search based on a given topic, identify relevant literature and evaluate this literature,
- give presentations in a scientific context in front of an auditorium to present the results oft he research,
- present results of the research in a seminar thesis as a scientific publication using format requirements such as those recommended by well-known publishers.

Content
In the seminar the student should learn to apply the research methods to a predefined topic area. The topics are based on research questions in marketing. This problem analysis requires a interdisciplinary examination. As a special option, the implementation of methodological solutions for market research can be accomplished and discussed with respect to its application.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Will be allocated according the individual topics.

Remarks
Students from Bachelor and Master Course can visit the seminar. The research topic as well as the evaluation of the work and the presentation will have a different focus between Bachelor and Master Course.

Course: Seminar in Discrete Optimization [2550491]

Coordinators: S. Nickel
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

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

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

Learning Outcomes
The student

- illustrates and evaluates classic and current research questions in discrete optimization,
- applies optimization models and algorithms in discrete optimization, also with regard to their applicability in practical cases (especially in Supply Chain and Health Care Management),
- successfully gets in touch with scientific working by an in-depth working on a special scientific topic which makes the student familiar with scientific literature research and argumentation methods,
- acquires good rhetorical and presentation skills.

As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the seminar topic.

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

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

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 Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
Term paper and presentation

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/).

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Slides.

Literature
Will be announced at the end of the recess period.

Course: Seminar in Continous Optimization [2550131]

Coordinators: O. Stein
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
The assessment is composed of a 15-20 page paper as well as a 40-60 minute oral presentation according to §4(2), 3 of the examination regulation.
The total grade is composed of the equally weighted grades of the written and oral assessments.
The seminar is appropriate for bachelor as well as for master students. Their differentiation results from different assessment criteria for the seminar paper and the seminar presentation.

Conditions
See corresponding module information.
Attendance is compulsory.
Preferably at least one module offered by the institute should have been chosen before attending this seminar.

Learning Outcomes
The seminar aims at describing, evaluating, and discussing recent as well as classical topics in continuous optimization. The focus is on the treatment of optimization models and algorithms, also with respect to their practical application.
The student is introduced to the style of scientific work. By focussed treatment of a scientific topic the student learns the basics of scientific investigation and reasoning.
For further development of a scientific work style, master students are particularly expected to critically question the seminar topics.
With regard to the oral presentations the students become acquainted with presentation techniques and basics of scientifc reasoning. Also rethoric abilities may be improved.

Content
The current seminar topics are announced under http://kop.ior.kit.edu at the end of the preceding semester.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

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 Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar		

Learning Control / Examinations

Conditions
None.

Recommendations
At least one of the courses *Theory of Business Cycles[25549]* and *Theory of Economic Growth [2520543]* should have been attended beforehand.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Will be announced at the end of the recess period.

Remarks
for details see German version.

Course: Seminar on Network Economics [2560263]

Coordinators: K. Mitusch
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
The assessment consists of a seminar paper of 15-20 pages, a presentation of results and active participation in the diskussion during the seminar (according to §4(2), 3 ERSC)
The grading is carried out primarily in reference to the seminar paper, however, divergent performance in the presentation will be accounted for by a corresponding adjustment. In particular, there is the chance to improve grades through good participation during the seminar.

Conditions
See module description.
Basic knowledge of network economics is required. The course *Competition in Networks* [26240] should be completed.

Learning Outcomes
The students

- will deepen their knowledge in network economics
- will be able to familiarize oneself with network economic topics and to examine and discuss a specific question
- will be able to present his/her results
- will get inspiration for a potential master thesis.

Content
The current theme of the seminar including the suggestion of topics for the seminar papers will be announced in KIM and on the notice board at the institute (http://netze.iww.kit.edu).
(The title of the seminar may change from term to term depending on the topic)

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Seminar Transport Economics [2561209]

Coordinators: K. Mitusch, E. Szimba
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
The students

- have learnt how to deal with a selected aspect of European transport planning, transport policy or transport modelling and to prepare a written summary on it (potentially in team work, depending on the subject)
- are able to present and discuss their work
- acquire competent knowledge on selected aspects of European transport planning, transport policy or transport modelling
- get inspiration for a potential master thesis

Content
This seminar is about current challenges in transport planning and transport politics in the European context.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Seminar: Legal Studies [RECHT]

Coordinators: Inst. ZAR
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Seminar: Sensorik [23233]

Coordinators: W. Menesklou
Part of the modules: Sensor Technology I (p. 140)[WI4INGETIT3], Sensor Technology II (p. 141)[WI4INGETIT5]

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

Learning Control / Examinations
The assessment consists of a term paper (ca. 30 pages) as well as an oral presentation and the discussion of the term paper results according to Section 4 (2), 3 of the examination regulation.
The overall grade consists of the of the grade of the term paper (40 percent) and the grade of the oral presentation (30 percent) and the discussion (30 percent).

Conditions
None.

Recommendations
Successful completion of the courses Electrical Engineering II [23224] and sensors [23231].

Learning Outcomes
The student will learn how to deal with a scientific topic, to analyze literature, to summarize the published results and to present them in a talk.

Content
This course is aimed to graduate students in Electrical and Industrial Engineering and Management. The student has to analyze scientific literature related to sensors. The results of this literature study have to be summarized in a paper and presented in a talk.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Will be announced in the lecture.

Course: Seminar: Management and Organization [2577915]

Coordinators: H. Lindstädt
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
Learning control is based on a written paper and a presentation of the results in a seminar session (according to §4(2), 3 SPO). Final grade is composed of both elements.

Conditions
Preferably, at least one of the institute's offered modules should be passed before participation in the seminar.

Learning Outcomes
After passing this course students are able to

- describe corporate and organizational management approaches and to clarify them using practical examples.
- critically assess these approaches building on the latest state of research.
- apply the principles of scientific research and argumentation to a specific issue.
- present and discuss selected topics to a group.

Content
The subjects are redefined each semester on the basis of current issues.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Slides.

Literature
The relevant sources are made known during the course.

Course: Seminar paper “Production Engineering” [21690sem]

Coordinators: V. Schulze, G. Lanza, J. Fleischer
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
The following work and performance is required for the successful completion of the seminar:

- active participation in the seminar,
- completion of a seminar paper on the topic of the seminar (minimum input: 80 h) and
- a presentation given after completion of the seminar paper.

The seminar paper can be submitted:

- for the module: *seminar module* [SemING] OR
- to improve the module grade of modules: *Manufacturing Engineering* [WI4INGMB23], *Integrated Production Planning* [WI4INGMB24] or *Vertiefung der Produktionstechnik* [WI4INGMB22].

Each seminar paper can be submitted only once. One paper cannot be submitted for both the seminar module and the improvement of the grade.

The score of the seminar paper can be used to improve the grade of one of the above-mentioned modules. The module grade can be improved by three tenths maximum. Only seminar papers written at wbk Institute of Production Science qualify for an improvement of the module grade.

One seminar paper can be used for the improvement of one module grade (named above) maximum. For the improvement of a grade, no more than one seminar paper can be submitted.

Conditions
None.

Learning Outcomes
The students are able to

- find appropriate data sources, evaluate and extract information.
- apply a predetermined citation style correctly.
- summarize information and results shortly and concisely in a written form.
- to design visual preparations of scientific problems or results and to make an oral presentation.
- to work in task-oriented cooperation as a team.

Content
Students independently deal with production engineering related problems from the fields of manufacturing engineering, machine tools and handling technology and organisation, planning and logistics with tutorial assistance. The results are aggregated in the form of a seminar paper and are then illustrated in the form of a presentation.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Lecture notes of the Institute of Production Science.

Course: Practical Seminar Knowledge Discovery [25810]

Coordinators: R. Studer
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Electives in Informatics (p. 82)[WI4INFO3], Informatics (p. 78)[WI4INFO1]

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

Learning Control / Examinations

Conditions
None.

Recommendations
Knowledge of algorithms in the area of knowledge discovery is assumed. Therefore it is recommended to attend the course [2511302] Knowledge Discovery beforehand.

Learning Outcomes
Students

- know fundamentals of Machine Learning, Data Mining and Knowledge Discovery
- are able to design, train and evaluate adaptive systems
- conduct Knowledge Discovery projects in regards to algorithms, representations and applications.

Content
The practical course will cover topics in the field of knowledge discovery. Each term, a different topic is covered, e.g.: text mining or learning with semantic data. Details will be announced every semester.

Workload

Activity		Effort
Presence Time	(3 x 2 x 45 min)	4h 30min
Getting acquainted		20h
Practical Work + Written Report		16h
Implementation and Evaluation		70h
Preparation of presentation		12h
Overall:		122h 30min

Media
Slides.

Course: Practical Seminar Service Innovation [2595477]

Coordinators: G. Satzger
Part of the modules: Business & Service Engineering (p. 42)[WI4BWLISM4], Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	3	practical seminar		de

Learning Control / Examinations
The assessment of this course is according to §4(2), 3 SPO in form of a written documentation, a presentation of the outcome of the conducted pracitical components and an active participation in class.
Please take into account that, beside the written documentation, also a practical component (such as a survey or an implementation of an application) is part of the course. Please examine the course description for the particular tasks.
The final mark is based on the graded and weighted attainments (such as the written documentation, presentation, practical work and an active participation in class).

Conditions
None.

Recommendations
Knowledge of Service Innovation Methods is assumed. Therefore it is recommended to attend the course Service Innovation [2540468] beforehand.

Learning Outcomes
The student should be able to do a literature review based on a given topic in the context of service innovation. The approach comprises the identification of relevant literature according to the topic and an analysis as well as the evaluation of the methods presented in the literature. The practical work components should enable the student to learn about and independently use scientific methods employed e.g. in case studies or experiments. The student learns to present his results in a paper and in front of an audience on an academic level. This process is helpful for further scientific work like the master or doctoral thesis.

Content
The Practical Seminar Service Innovation conveys both a theoretical foundation and practical methods. Using a case example of real-world challenges in the area of Service Innovation, application and adaptation of innovation methods are taught and the results are presented. This project work applies conceptual, analytical and creative methods.

Workload
The total workload for this course is approximately 135 hours. For further information see German version.

Literature
The foundational literature will be announced together with the individual topics.

Remarks
The credits have been changed from 5 to 4,5.
Due to the project work, the number of participants is limited and participation requires knowledge about models, concepts and approaches that are taught in the Service Innovation lecture. Having taken the Service Innovation lecture or demonstrating equivalent knowledge is a prerequisite for participating in this Practical Seminar. Details for registration will be announced on the web pages for this course.

Course: Sensors [23231]

Coordinators: W. Menesklou
Part of the modules: Sensor Technology I (p. 140)[WI4INGETIT3]

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

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

Conditions
See module description.

Learning Outcomes
The student should acquire fundamental principles in material science and device technology of sensors to be able to apply materials and sensors from the viewpoint of an application or development engineer.

Content
Mechanical Sensors (strain gauges, piezoelectric sensors),Thermal Sensors, Optical Sensors, Magnetic sensors, Acoustic Sensors, Gas Sensors (Lambda Probes, Taguchi, Electronic Nose), Bio and Chemical Sensors.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Online material is available.

Literature
Elective literature:
Schaumburg, H.: Sensoren. Stuttgart, Teubner 1992
Tränkler, H.-R., Obermeier, E. (Hrsg.): Sensortechnik. Springer, Berlin Heidelberg 1998

Course: Sensor Systems (Integrated Sensor Actuator Systems) [23240]

Coordinators: W. Wersing
Part of the modules: Sensor Technology I (p. 140)[WI4INGETIT3], Sensor Technology II (p. 141)[WI4INGETIT5]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
The assessment consits of an oral exam (20 min) according to Section 4(2), 2 of the examination regulation.
The examination takes place in every summer semester. Re-examinations are offered at eyery ordinary examination date.

Conditions
None.

Recommendations
It is recommended to attend the courses *Material Science II* [21782] and *Electrical Engineering II* [23224] beforehand.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Elective literature:

- Piezoelectricity: Evolution and Future of a Technology (Springer Series in Materials Science), W. Heywang, K. Lusitz, W. Wersing; Springer 2008
- Principles and Applications of Ferroelectrics and Related Materials, M.E. Lines, A.M. Glas, Clarendon Press, Oxford, 1977.
- Einführung in die Ferroelektrizität, A.S. Sonin, B.A. Strukow, Vieweg Verlag, Braunschweig, 1974
- Piezoelectricity, G.W. Taylor, Gordon Breach Verlag, London, 1977

Course: Service Analytics [2595501]

Coordinators: T. Setzer, H. Fromm
Part of the modules: Service Management (p. 43)[WI4BWLISM6], Service Analytics (p. 59)[WI4BWLKSR1], Advanced CRM (p. 37)[WI4BWLISM1]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise	Summer 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
None.

Recommendations
The lecture is addresed to students with interests and basic knowledge in the topics of Operations Research, decritptive and inductive statistics.

Learning Outcomes
Participants are able to structure large sets of available data and to use that data for planning, operation, personalization of complex services, in particular for IT services. They learn a step-by-step approach starting with analyzing possibly incomplete data, techniques of multivariate statistics to filter data and to extract data features, forecast techniques, and robust planning and control procedures for enterprise decision support.

Content
Today's service-oriented companies are starting to optimize the way services are planned, operated, and personalized by analyzing vast amounts of data from customers, IT-systems, or sensors. As the statistical learning and business optimization world continues to progress, skills and expertise in advanced data analytics and data and fact-based optimization become vital for companies to be competitive. In this lecture, relevant methods and tools will be considered as a package, with a strong focus on their inter-relations. Students will learn to analyze and structure large amounts of potentially incomplete and unreliable data, to apply multivariate statistics to filter data and to extract key features, to predict future behavior and system dynamics, and finally to formulate data and fact-based service planning and decision models.
More specifically, the lessons of this lecture will include:

- Co-Creation of Value Across Enterprises
- Instrumentation, Measurement, Monitoring of Service Systems
- Descriptive, predictive, and prescriptive Analytics
- Usage Characteristics and Customer Dynamics
- Big Data, Dimensionality Reduction, and Real-Time Analytics
- System Models and What-If-Analysis
- Robust Mechanisms for Service Management
- Industry Applications of Service Analytics

Tutorials
Students will conduct lecture accompanying, guided exercises throughout the semester.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media

- PowerPoint
- E-learning platform ILIAS

Literature

- Business Forecasting, Wilson, J. H., Keating, B., McGraw-Hill, 2002
- Multivariate Data Analysis, Hair, J. F., Black, B., Babin, B., Anderson, R. E., 2008
- Analytics at Work, Davenport, T. H., Harris, J. G., Morion, R., Harward Business Press, 2010
- Business Analytics for Managers, Jank, W., Springer, 2011

Online Sources:

- The data deluge, The Economist, Feb. 2010
- Competing on Analytics, T. Davenport in Harward Business Review, Feb. 2007
- Mit Advanced Analytics können Händler Kundendaten optimal nutzen, McKinsey Handelsmarketing, Feb. 2011

Further readings will be provided in the lecture.

Course: Service Analytics II – Enterprise Data Reduction and Prediction [2540498]

Coordinators: T. Setzer, C. Weinhardt
Part of the modules: Service Analytics (p. 59)[WI4BWLKSR1]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise	Summer 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
None.

Learning Outcomes
The students

- learn to assess and improve (pre-process) the quality of vast amounts of high-dimensional enterprise data
- learn to select and combine optimal features for forecasting and planning tasks,
- and learn how to (non-linearly) predict scenarios with causal/probabilistic network models including complex diagnostics, de-biasing, aanomaly-detection temporal reasoning.

In total, the students understand data-driven analytical techniques and structured procedures to support forecasting and planning processes in today's corporations.

Content
Analytical Processes for enterprise planning and decision making are increasingly based on (semi-) automated statistical/mathematical techniques to analyze large amounts of high-dimensional, heterogeneous, and often noisy enterprise data.
The students learn techniques together with structured procedures to

1. preprocess and reduce large amounts of high-dimensional enterprise data,
2. select and combine data features such as elastic nets or empirical-orthogonal configurations, as well as blending and de-biasing techniques,
3. and to consider and reduce uncertainty and biases in daten-based enterprise forecasting and planning tasks.

The students understand and know how and when to apply a techique, how to orchestrate, evaluate, and ajdust the methods, and can have the means to provide a better and more robust basis for data-driven enterprise forecasting and planning.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Lecture notes

Literature
Will be announced via WWW and in the first session of this lecture.

Remarks
The course has beed added summer term 2015.
Limited number of slots

Course: Service Design Thinking [2595600]

Coordinators: C. Weinhardt
Part of the modules: Service Design Thinking (p. 60)[WI4BWLKSR2]

ECTS Credits	Hours per week	Type	Term	Instruction language
9	6	other	Winter / Summer Term	en

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
The course is compulsory and must be examined.

Learning Outcomes

- Deep knowledge of the innovation method “Design Thinking”, as introduced and promoted by Stanford University
- Development of new, creative solutions through extensive observation of oneself and one’s environment, in particular with regard to the relevant service users
- Know how to use prototyping and experimentation to visualize one’s ideas, to test and iteratively develop them, and to converge on a solution
- Communicate, work and present in an interdisciplinary and international project setting

Content

- Paper Bike: Learning about the basic method elements by building a paper bike that has to fulfill a given set of challenges.
- Design Space Exploration: Exploring the problem space through customer and user observation.
- Critical Function Prototype: Identification of critical features from the customer’s perspective that can contribute to the solution of the overarching problem. Building and testing prototypes that integrate these functionalities.
- Dark Horse Prototype: Inverting earlier assumptions and experiences, which leads to the inclusion of new features and solutions.
- Funky Prototype: Integration of the individually tested and successful functions to a complete solution, which is further tested and developed.
- Functional Prototype: Further selection and convergence of existing ideas. Building a higher resolution prototype that can be tested by customers.
- Final Prototype: Preparing and presenting the final solution to the customer.

Workload
The total workload for this course is approximately 270 hours. For further information see German version.

Remarks
Due to the project nature of the course, the number of participants is limited. For further information see german version.

Course: Service Innovation [2595468]

Coordinators: G. Satzger, M. Kohler, N. Feldmann
Part of the modules: Business & Service Engineering (p. 42)[WI4BWLISM4], Service Management (p. 43)[WI4BWLISM6]

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

Learning Control / Examinations
The assessment consists of an 1h written exam following §4(2), 3 SPO and of assignments during the course as an "Erfolgskontrolle anderer Art" following §4(2), 3 SPO.

Conditions
None.

Learning Outcomes
Understand the difference between innovation and invention, and how disruptive effects can be fast and wide-reaching.
Know examples for innovation in processes, organization and business models; understand how service and product innovation differ.
Understand the link between risk and innovation; be aware of obstacles to innovation and know how to overcome them.

Content
While innovation in manufacturing or agriculture can leverage a considerable body of research, experience and best practice, innovation in services has not reached the same level of maturity. In practice, while many organizations have a well-understood process for innovating in the product business, innovating in services is often still a fuzzy and complex undertaking. In this lecture we will discuss the state of research, compare product and service innovation, understand how innovation diffusion works, examine case studies on service innovation, compare open vs. closed innovation, learn how to leverage user communities to drive innovation and understand obstacles as well as enablersand how to manage, incentivize and foster service innovation.

Workload
The total workload for this course is approximately 135 hours. For further information see German version.

Literature

- Barras, Richard (1986) Towards a theory of innovation in services. Research Policy 15, 161-173
- Hauschildt, Jürgen und Salomo, Sören (2007) Innovationsmanagement. 4. Auflage, München: Vahlen.
- von Hippel, Erich (2007) Horizontal innovation networks - by and for users. Industrial and Corporate Change, 16:2
- Sundbo, Jon (1997) Management of Innovation in Services. The Service Industries Journal, Vo. 17, No. 3, pp. 432-455

Elective literature:

- Benkler, Yochai (2006) The Wealth of Networks: How Social Production Transforms Markets and Freedom. Yale University Press. (Online: http://www.benkler.org)
- Christensen, Clayton M. (2003) The Innovator's Dilemma, Harper Collins.
- Kanerva, M.; Hollanders, H. & Arundel, A. (2006) TrendChart Report: Can we Measure and Compare Innovation in Services?
- von Hippel, Erich (2005) Democratizing Innovation. The MIT Press, Cambridge, MA. (Online: http://web.mit.edu/evhippel/www/books/D
- Howells, Jeremy & Tether, Bruce (2004) Innovation in Services: Issues at Stake and Trends. Commission of the European Communities, Brussels/Luxembourg. (Online: http://www.isi.fhg.de/publ/downloads/isi04b25/inno-3.pdf)
- Miles, I. (2008) Patterns of innovation in service industries. IBM Systems Journal, Vol. 47, No 1
- Morison, Eltling E. (1966) Gunfire at Sea: A Case Study of Innovation. In: Men, Machines and Modern Times. The MIT Press, pp. 17-44.

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

Course: Service Oriented Computing 2 [2511308]

Coordinators: R. Studer, S. Agarwal, B. Norton
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	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.

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Literature
Literature will be announced in the lecture.

Course: Services Marketing [2572202]

Coordinators: J. Kim
Part of the modules: Services Marketing (p. 56)[WI4BWLMAR9]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (60 min) (according to §4(2)

Conditions
None.

Learning Outcomes
Students

- understand the importance of a customer relationship management
- learn the standards of service design
- learn about the 4ps in the service context
- gain knowledge about content and strategies of services marketing
- learn about methods and models to measure service quality

Content
The aim of this lecture is to provide an overview of marketing management in the service context. The lecture starts with foundations for service marketing such as consumer behavior and expectations in services. Then students learn about the importance of the customer relationship for services. They also learn about the 4ps in the service context and gain knowledge about content and strategies of services marketing. They further learn about methods and models for services marketing.

Workload
The total workload for this course is approximately 90.0 hours. For further information see German version.

Media
Lecture slides will be provided in ILIAS

Literature
Fitzsimmons, J. A., & Fitzsimmons, M. J. (2010). Service management: operations, strategy, and information technology. Singapore: McGraw-Hill.
Zeithaml, V. A., Bitner, M. J., & Gremler, D. D. (2006). Services marketing: Integrating customer focus across the firm.
See lecture slides for further recommendations on literature

Remarks
new course starting summer term 2016

Course: Safety Management in Highway Engineering [6233906]

Coordinators: M. Zimmermann
Part of the modules: Safety, Computing and Law in Highway Engineering (p. 130)[WI4INGBGU9]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture + exercise	Winter term	de

Learning Control / Examinations
See module description.

Conditions
See corresponding module information.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Remarks
For further information, see http://www.ise.uni-karlsruhe.de/16.php

Course: Safety Engineering [2117061]

Coordinators: H. Kany
Part of the modules: Technical Logistics (p. 106)[WI4INGMB27], Introduction to Logistics (p. 99)[WI4INGMB20]

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

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

Conditions
None.

Recommendations
None.

Learning Outcomes
Students are able to:

- Name and describe relevant safety conceps of safety engeneering,
- Discuss basics of health at work and labour protection in Germany,
- Evaluate the basics for the safe methods of design of machinery with the national and european safety regulations and
- Realize these objectives by using examples in the field of storage and material handling systems.

Content
The course provides basic knowledge of safety engineering. In particular the basics of health at the working place, job safety in Germany, national and European safety rules and the basics of safe machine design are covered. The implementation of these aspects will be illustrated by examples of material handling and storage technology. This course focuses on: basics of safety at work, safety regulations, basic safety principles of machine design, protection devices, system security with risk analysis, electronics in safety engineering, safety engineering for storage and material handling technique, electrical dangers and ergonomics. So, mainly, the technical measures of risk reduction in specific technical circumstances are covered.

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
presentations

Literature
Defren/Wickert: Sicherheit für den Maschinen- und Anlagenbau, Druckerei und
Verlag: H. von Ameln, Ratingen, ISBN: 3-926069-06-6

Remarks
none

Course: Water Supply and Sanitation [6200603]

Coordinators: S. Fuchs
Part of the modules: Water Supply and Sanitation (p. 131)[WI4INGBGU13]

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

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

Conditions
None.

Learning Outcomes
The Students have a wide range of basic expertise regarding the requirements of water management and urban water management tasks to the planning engineer. They will be competent in the areas of application, the function and in terms of methodological approaches to the assessment and planning of water management activities and urban water systems.

Content
See German version.

Workload
The total workload for this course is approximately 135 hours. For further information see German version.

Course: Simulation of Coupled Systems [2114095]

Coordinators: M. Geimer
Part of the modules: Mobile Machines (p. 96)[WI4INGMB15], Vehicle Development (p. 95)[WI4INGMB14]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture + exercise	Summer term	de

Learning Control / Examinations
Assessment for the module *Mobile Machines*: See module description.
Assessment for the module *Automotive Engineering*: The assessment consists of an oral exam (20 min) taking place in 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.

Recommendations
It is recommended to have:

- Knowledge of ProE (ideally in actual version)
- Basic knowledge of Matlab/Simulink
- Basic knowledge of dynamics of machines
- Basic knowledge of hydraulics

Learning Outcomes
After completion of the course, students are able to:

- building a coupled simulation
- parameterize models
- Perform simulations
- do Troubleshooting
- check results for plausibility

Content

- Knowledge of the basics of multi-body and hydraulic simulation programs
- Possibilities of coupled simulations
- Development of a simulation model by using the example of a wheel loader
- Documentation of the result in a short report

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Elective literature:

- miscellaneous guides according the software-tools pdf-shaped
- information to the wheel-type loader

Course: Simulation I [2550662]

Coordinators: K. Waldmann
Part of the modules: Stochastic Modelling and Optimization (p. 87)[WI4OR7]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1/2	lecture + exercise + tutorial	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following Section 4(2), 1 of the examination regulation. Credit from the voluntary computer lab is accounted for in the overall grade raising the exam grade by a 2/3 step of a full grade (according to Section 4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
The participants will be enabled to model discrete event systems that underlie stochastic influences and to analyze them using simulation. The discussion of practice-oriented case studies pursues two goals. On the one hand, the participants will be sensitized for different criteria to evaluate the performance of a stochastic discrete-event system. On the other hand, an overview of application areas of stochastic simulation is provided. In the context of the course, the basic elements of discrete-event simulation are introduced and a procedure model for the execution of simulation studies is developed. Properties of existing mathematical methods for the generation of random variables are discussed and are assigned to concrete application cases. Statistical methods for the description of simulation input data and for the interpretation of simulation results will be exemplified. The facultative computer exercise course using a simulation software comprises a practice-oriented case study that illustrates the opportunities and limitations of stochastic simulation.

Content
Generation of random numbers, Monte Carlo Integration, discrete event simulation, discrete random variables, continuous random variables, statistical analysis of simulated data.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Blackboard, slides, flash-animations, java tools, simulation software.

Literature

- Lecture Notes
- K.-H. Waldmann/U. M. Stocker: Stochastische Modelle - Eine anwendungsorientierte Einführung, Springer (2012), 2. Auflage
- Elective literature: A. M. Law/W.D. Kelton: Simulation Modeling and Analysis (3rd ed), McGraw Hill (2000)

Remarks
The course will be offered in the summer term 2015 and the summer term 2016.

Course: Simulation II [2550665]

Coordinators: K. Waldmann
Part of the modules: Stochastic Modelling and Optimization (p. 87)[WI4OR7]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1/2	lecture + exercise + tutorial	Winter / Summer Term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following Section 4(2), 1 of the examination regulation. Credit from the voluntary computer lab is accounted for in the overall grade raising the exam grade by a 2/3 step of a full grade (according to Section 4(2), 3 of the examination regulation).

Conditions
Foundations in the field of *Simulation I* [2550662] are desired.

Learning Outcomes
The participants will be enabled to model and analyze discrete event systems that underlie stochastic influences with efficient simulation techniques. The discussion of practice-oriented case studies illustrates the limits of standard simulation techniques for stochastic discrete event systems regarding the simulation effort to obtain statistical significant results. Variance reducing techniques will be introduced in theory as modern and efficient techniques and will be exemplified by examples from quality management, financial engineering and insurance. The main scope of the applications discussed in the course is the efficient simulation of stochastic processes. The facultative computer exercise course under utilization of the programming language Java comprises a practice-oriented case study, in which the participants implement certain variance reducing techniques in order to analyze the reduction in computer effort in comparison to standard techniques.

Content
Variance reducing techniques, simulation of sochastic processes, case studies.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Blackboard, slides, flash-animations, java tools, simulation software.

Literature

- Lecture Notes
- K.-H. Waldmann/U. M. Stocker: Stochastische Modelle - Eine anwendungsorientierte Einführung, Springer (2012), 2. Auflage
- Elective literature: A. M. Law/W.D. Kelton: Simulation Modeling and Analysis (3rd ed), McGraw Hill (2000)

Remarks
The course will be offered in the winter term 2015/2016.

Course: Traffic Flow Simulation [6232804]

Coordinators: P. Vortisch
Part of the modules: Transportation Modelling and Traffic Management (p. 134)[WI4INGBGU16]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	1/1	lecture + exercise	Summer term	de

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

Conditions
See module description.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Smart Energy Distribution [2511108]

Coordinators: H. Schmeck
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2	lecture	Summer term	en

Learning Control / Examinations
written exam, unless the number of registered students is too small.

Conditions
The students should have an understanding of informatics, they would benefit from some previous knowledge of self-organisation and methods for optimisation, but this is not mandatory

Learning Outcomes
The students will develop an understanding of the basic problems that arise from decentralisation and an increased share of renewables in the power mix and they will know how to deal with these problems by using concepts like virtualisation and self-organisation. They will know how to design and apply adequate methods for smart energy distribution in various related problem settings and they will be capable to explain the appropriate use of these methods. The students will get to know the scope of topics in energy informatics.

Content
The course addresses the challenges of the Energiewende with respect to the role of information and communication technologies for shaping tomorrow's engery systems. The increasing share of power generation from renewable sources and the decentralisation of power generation lead to an increasing need for local balancing of power supply and demand. While traditional power management was based on the assumption that power consumption is not controllable and that electric power cannot be stored effectively, future power management will depend significantly on much more flexibility in demand and in innovative ways of storing energy.
The course will present concepts for smart energy management that have been developed in projects on "e-energy" and "ICT for Electric Mobility", like virtual power plants, local agent-based power management, concepts of load shifting, autonomic and organic approaches to power management in smart homes, utilization of mobile and stationary batteries for stabilization of the power grid. Furthermore, it addresses aspects of security and privacy due to the pervasive use of ICT in energy systems.
The concepts presented in this course are essential topics of the emerging discipline of Energy Informatics.

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Media
slides, on screen annotations , lecture recording using camtasia

Remarks
This course is offered to students of the (KIC) MSc program EnTech but may also be taken by students of the Master programs Industrial Engineering, Economics Engineering, Information Engineering and Management, and Mathematics in Economics.

Course: Social Choice Theory [2520537]

Coordinators: C. Puppe
Part of the modules: Collective Decision Making (p. 73)[WI4VWL16], Microeconomic Theory (p. 72)[WI4VWL15]

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

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

Conditions
None.

Recommendations
None.

Learning Outcomes
The student should acquire knowledge of formal theories of collective decision making and learn to apply them to real life situations.

Content
The course provides a comprehensive treatment of preference and judgement aggregation, including proofs of general results that have Arrow's famous impossibility theorem and Gibbard's oligarchy theorem as corollaries. The second part of the course is devoted to voting theory. Among other things, we prove the Gibbard-Satterthwaite theorem. An introduction into tournament theory concludes the course.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Main texts:

- Hervé Moulin: Axioms of Cooperative Decision Making, Cambridge University Press, 1988
- Christian List and Clemens Puppe: Judgement Aggregation. A survey, in: Handbook of rational & social choice, P.Anand, P.Pattanaik, C.Puppe (Eds.), Oxford University Press 2009.

Secondary texts:

- Amartya Sen: Collective Choice and Social Welfare, Holden-Day, 1970
- Wulf Gaertner: A Primer in Social Choice Theory, revised edition, Oxford University Press, 2009
- Wulf Gaertner: Domain Conditions in Social Choice Theory, Oxford University Press, 2001

Course: Software Laboratory: OR Models II [2550497]

Coordinators: S. Nickel
Part of the modules: Operations Research in Supply Chain Management and Health Care Management (p. 84)[WI4OR5]

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

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

Conditions
Successful completion of the course *Software Laboratory: OR-Models I* [2550490].
Basic knowledge as conveyed in the module *Introduction to Operations Research* [WI1OR] is assumed.

Learning Outcomes
The student

- is an expert in using computer systems to model and solve industry-related optimization problems,
- conducts an advanced approach to modeling and implementation software for OR models and is able to use them in practice,
- knows and explains the practical application possibilities of OR software in complex combinatorial and nonlinear optimization problems.

Content
The task of solving combinatorial and nonlinear optimization problems imposes much higher requirements on suggested solution approaches as in linear programming.
During the course of this software laboratory, students get to know important methods from combinatorial optimization, e.g. Branch & Cut- or Column Generation methods and are enabled to solve problems with the software system IBM ILOG CPLEX Optimization Studio and the corresponding modeling language OPL. In addition, issues of nonlinear optimization, e.g. quadratic optimization, are addressed. As an important part of the software laboratory, students get the possibility to model combinatorial and nonlinear problems and implement solution approaches in the software system.
The software laboratory also introduces some of the most frequently used modelling and programming languages that are used in practice to solve optimization problems.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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

Course: Software Quality Management [2511208]

Coordinators: A. Oberweis
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Summer term	de

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

Conditions
Programming knowledge in Java and basic knowledge of computer science are expected.

Learning Outcomes
Students

- explain the relevant quality models,
- apply methods to evaluate the software quality and evaluate the results,
- know the mail models of sofware certification, compare and evaluate these models,
- write scientific theses in the area of software quality management and find own solutions for given problems.

Content
This lecture imparts fundamentals of active software quality management (quality planning, quality testing, quality control, quality assurance) and illustrates them with concrete examples, as currently applied in industrial software development. Keywords of the lecture content are: software and software quality, process models, software process quality, ISO 9000-3, CMM(I), BOOTSTRAP, SPICE, software tests.

Workload
Warning: not a valid latex tabular environment.

Media
Slides, access to internet resources.

Literature

- Helmut Balzert: Lehrbuch der Software-Technik. Spektrum-Verlag 2008
- Peter Liggesmeyer: Software-Qualität, Testen, Analysieren und Verifizieren von Software. Spektrum Akademischer Verlag 2002
- Mauro Pezzè, Michal Young: Software testen und analysieren. Oldenbourg Verlag 2009

Elective literature:
Further literature is given in lectures.

Remarks
This course was formely named “Software Technology: Quality Management”.

Course: Social Network Analysis in CRM [2540518]

Coordinators: A. Geyer-Schulz
Part of the modules: Advanced CRM (p. 37)[WI4BWLISM1]

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

Learning Control / Examinations
Assessment consists of a written exam of 1 hour length following §4 (2), 1 of the examination regulation and by submitting written papers as part of the exercise following §4 (2), 3 of the examination regulation.
The course is considered successfully taken, if at least 50 out of 100 points are acquired in the written exam. In this case, all additional points (up to 10) from excersise work will be added. The grades of this lecture are assigned following the table below:
\begin{tabular}{cc}
Grade & Minimum points \\
\hline
1.0 & 95 \\
1.3 & 90 \\
1.7 & 85 \\
2.0 & 80 \\
2.3 & 75 \\
2.7 & 70 \\
3.0 & 65 \\
3.3 & 60 \\
3.7 & 55 \\
4.0 & 50 \\
\hline
5.0 & 0 \\
\end{tabular}

Conditions
None.

Learning Outcomes
The objectives of this course are to give students an introduction to and overview of social network analysis as a methodological approach for analysis in different areas of business administration, especially customer relationship management. Theory as well as application of social network analysis will be discussed. Students will learn how to perform and interpret analysis results.

Content
The trend to view economic and social structures as networks allows to anlysze these networks by well established and new methods from mathematics, business administration, sociology and phyiscs. The goal of these analyses are to understand different aspects of these networks: In organizations (internal Marketing): Here networks analysis kann help to detect whether hierarchies and official structures are 'alive' or if so called 'hidden organizations' have evolved. In addition such results can reveal ineffient procedures or structures within an organization. In CRM: Within analytical CRM the concept of customer value can be enriched by enclosing the network value that customer offers to the company (Customer Network Value). In Marketing: To successfully implement a virale marketing strategy the knowledge of the structure of customer networks is essential. The dynamics on these networks are relevant if one wants to use these networks for marketing purposes. Internetstructure: For information services, such as e.g. search engines, ithe identification of relevant nodes and clusters is a the major service profided and thus relevant for business success.
The analysis should identify the relevant (central) nodes in a network, find cliques, describe their connections and, if relevant, describe alos the direction of information flow within the network. To achieve this different methods will be discussed during the course.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Folien

Literature
Christian Grönroos. Service Management and Marketing : A Customer Relationship Management Approach. Wiley, Chicester, 2 edition, 2000.
Sabrina Helm. Viral marketing: Establishing customer relationships by word-of-mouse. Electronic Markets, 10(3):158–161, Jul 2000.
Dieter Jungnickel. Graphs, Networks and Algorithms. Number 5 in Algorithms and Computation in Mathematics. Springer Verlag, Berlin, 1999.

Leo Katz. A new status index derived from sociometric analysis. Psychometrika, 18(1):39–43, Mar 1953.
Jon M. Kleinberg. Authoritative sources in a hyperlinked environment. JACM, 46(5):604–632, sep 1999.
Barry Wellman Laura Garton. Social impacts of electronic mail in organizations: A review of research literature. Communication Yearbook, 18:434–453, 1995.
Carl D. Meyer. Matrix Analysis and Applied Linear Algebra. Society for Industrial and Applied Mathematics, Philadelphia, 2000.
Andrew Richards, William ; Seary. Eigen analysis of networks. Journal of Social Structure, 1(2), Feb 2000.
Pacey C. Foster Stepehen P. Borgatti. The network paradigm in organizational research: A review and typology. Journal of Management, 29(6):991–1013, 2003.
Mani R. Subramani and Balaji Rajagopalan. Knowledge-sharing and influence in online social networks via viral marketing. Communications of the ACM, 46(12):300–307, Dec 2003.
Stanley Wasserman and Katherine Faust. Social Network Analysis: Methods and Applications, volume 8 of Structural Analysis in the Social Sciences. Cambridge University Press, Cambridge, 1 edition, 1999.
Barry Wellman. Computer networks as social networks. Science, 293:2031–2034, Sep 2001.

Remarks

The course is currently not offered.

Course: Spatial Economics [2561260]

Coordinators: I. Ott
Part of the modules: Growth and Agglomeration (p. 69)[WI4VWL12], Agglomeration and Innovation (p. 70)[WI4VWL13], Transport infrastructure policy and regional development (p. 68)[WI4VWL11]

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

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

Conditions
None.

Recommendations
Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012], and Economics II [2600014]. In addition, an interest in quantitative-mathematical modeling is required. The attendance of the course Introduction to economic policy [2560280] is recommended.

Learning Outcomes
The student

- analyses how spatial distribution of economic activity is determined
- uses quantitative methods within the context of economic models
- has basic knowledge of formal-analytic methods
- understands the link between economic theory and its empirical applications
- understands to what extent concentration processes result from agglomeration and dispersion forces
- is able to determine theory based policy recommendations

Content
Geography, trade and development
Geography and economic theory
Core models of economic geography and empirical evidence
Agglomeration, home market effect, and spatial wages
Applications and extensions

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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.

Course: Special Topics in Management Accounting [2579905]

Coordinators: M. Wouters, F. Stadtherr
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar		en

Learning Control / Examinations
The final grade of the course is the grade awarded to the paper.

Conditions
The LV "Betriebswirtschaftslehre: Finanzwirtschaft und Rechnungswesen" (2610026) must have been completed before starting this seminar.

Learning Outcomes
Students
• are largely independently able to identify a distinct topic in Management Accounting,
• are capable to research the topic, analyze the information, to conceptualize and deduct fundamental principles and relationships from relatively unstructured information,
• can afterwards logically and systematically present the results in writing and as an oral presentation, following a scientific approach (structuring, terminology, sources.

Content
The course will be a mix of lectures, discussions, and student presentations. Students will write a paper in small groups, and present this in the final week. Topics are selectively prediscibed. The seminar course is concentrated in four meetings that are spread throughout the semester.
Meeting 1: Introductory lecture. You need to conduct a first literature search and at the end of the first week you should identify (provisionally) the topic for your paper.
Meeting 2 and 3: The purpose of the second week is to define the topics and research questions in much more detail. Different types of papers may be selected: literature review, research paper, descriptive case study, or teaching case. Students will present their ideas and all participants should ask questions, help each other focus, offer ideas, etc.
Meeting 4: In the third week we are going to present and discuss the final papers.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Will be announced in the course.

Remarks
Maximum of 24 students.

Course: Special Topics in Information Engineering & Management [2540498]

Coordinators: C. Weinhardt
Part of the modules: Information Engineering (p. 44)[WI4BWLISM7], Service Analytics (p. 59)[WI4BWLKSR1], Business & Service Engineering (p. 42)[WI4BWLISM4]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	3	practical seminar	Winter / Summer Term	de

Learning Control / Examinations
The assessment of this course is according to §4(2), 3 SPO in form of a written documentation, a presentation of the outcome of the conducted pracitical components and an active participation in class.
Please take into account that, beside the written documentation, also a practical component (such as a survey or an implementation of an application) is part of the course. Please examine the course description for the particular tasks.
The final mark is based on the graded and weighted attainments (such as the written documentation, presentation, practical work and an active participation in class)

Conditions
None.

Learning Outcomes
Students are able to

- do literature search based on a given topic: identify relevant literature, find, assess and evaluate this literature.
- do additional practical components in order to apply scientific methods (e.g., case studies, software implementations, surveys, or experiments).
- 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
In this course the student should learn to apply the search methods to a predefined topic area. The topics are based on research questions in Information Engineering and Management across different industry sectors. This problem analysis requires an interdisciplinary examination. Experiments, case studies or software development can be part of the practical work that offers the students an opportunity to get a deeper insight into the field of Information Engineering and Management. The course also encompases a documentation of the implemented work.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media

- PowerPoint
- E-learning platform ILIAS
- Software tools for development, if needed

Literature
The basic literature will be made available to the student according to the respecitive topic.

Remarks
All the practical seminars offered at the chair of Prof. Dr. Weinhardt can be chosen in the Special Topics in Information Engineering & Management course. The current topics of the practical seminars are available at the following homepage: www.iism.kit.edu/im/lehre
The Special Topics Information Engineering and Management is equivalent to the practical seminar, as it was only offered for the major in "Information Management and Engineering" so far. With this course students majoring in "Industrial Engineering and Management" and "Economics Engineering" also have the chance of getting practical experience and enhance their scientific capabilities.
The Special Topics Information Engineering and Managementcan be chosen instead of a regular lecture (see module description). Please take into account, that this course can only be accounted once per module.

Course: Special Topics of Enterprise Information Systems [SBI]

Coordinators: A. Oberweis
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Winter / Summer Term	de

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

Conditions
None.

Learning Outcomes
Students

- explain basic knowledge and concepts in a subarea of "Enterprise Information Systems",
- apply methods and instruments in a subarea of "Enterprise Information Systems",
- choose the appropriate methods to solve given problems and apply them,
- find and discuss arguments for solution approaches.

Content
This course is a placeholder for special courses that are offered in an irregular sequence and cover selected topics in the field of enterprise information systems. These topics include in particular the design and the management of database systems, the computer-support of business processes and strategic planning of information systems and their organization.

Workload
Lecture 30h
Exercise 15h

Preparation of lecture 30h
Preparation of exercises 30h
Exam preparation 44h
Exam &1h

Total: 150h

Literature
Will be announced at the beginning of the course.

Course: Special Topics of Efficient Algorithms [25700sp]

Coordinators: H. Schmeck
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

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

Learning Control / Examinations
The assessment consists of assignments or of a bonus exam (wrt §4 (2), 3 SPO), and a written exam (60 min.) in the week after the end of the lecturing periodwrt (§4 (2), 1 SPO). The exam will be offered in every semester and can be repeated on regular examination dates.
If the mark obtained in the written exam is in between 1.3 and 4.0, a successful completion of the assignments or the bonus exam will improve the mark by one level (i.e. by 0.3 or 0.4).

Conditions
None.

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

Content
This course emphasizes the new topics in the area of algorithms, data structures, and computer infrastructures. The exact topics can vary according to the audiences and the time it is held.

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Literature
Elective literature:
Will be announced in the lecture.

Remarks
This course can be particularly used for recognising the external courses with the topics in the area of algorithms, data-structures and computer infrastructures but are not associated in other courses in this subject area.

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

Coordinators: A. Oberweis
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Winter / Summer Term	

Learning Control / Examinations
The assessment consists of an 1h written exam in the first week after lecture period.

Conditions
None.

Learning Outcomes
Students

- explain basic knowledge and concepts in a subarea of “Software and Systems Engineering”,
- apply methods and instruments in a subarea of “Software and Systems Engineering”,
- choose the appropriate methods to solve given problems and apply them,
- find and discuss arguments for solution approaches.

Content
This course is a placeholder for special courses that are offered in an irregular sequence and cover selected topics in the field of software and systems engineering.

Workload
Lecture 30h
Exercise 15h

Preparation of lecture 30h
Preparation of exercises 30h
Exam preparation 44h
Exam &1h

Total: 150h

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: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

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

Learning Control / Examinations
Assesment is provided by a written exam of 60 minutes or an oral exam during the first few weeks after the lecturing period (acc. to §4(2), 1 or 2 SPO). The exam is offered each semester and may be repeated at the regular examination day.

Conditions
None.

Learning Outcomes
The lecture serves as placeholder for course achievements abroad.
The students acquire the skills, methods and tools in one specialized topic of “knowledge management” to demonstrate their mastery and innovativeness.
The lecture aims at providing principles and methods in the context of the practical application of KM. On the basis of a fundamental understanding of concepts, methods, and tools, students will be able to work on advanced problems. The students will be able to find and argue for solutions of KM problems.

Content
The lecture serves as placeholder for course achievements abroad.
The lecture deals with special topics in the area of knowledge management (incl. Knowledge Discovery and Semantic Web). The lecture deepens one of the following topics:

- Dynamic and Interoperable Systems in Knowledge Management
- Personal and Process-oriented Knowledge Management
- Formal Concept Analysis
- Semantic Search and Text Mining
- Combination of Social Software and Semantic Web

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

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. 86)[WI4OR6]

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

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

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

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

The examination can also be combined with the examination of *Special Topics in Optimization II* [25126]. In this case, the duration of the written examination takes 120 minutes.

Conditions
None.

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

Learning Outcomes
The student

- knows and understands the fundamentals of a special topic in continuous optimization,
- is able to choose, design and apply modern techniques of this special topic in continuous optimization in practice.

Content

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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. 86)[WI4OR6]

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

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

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

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

The examination can also be combined with the examination of *Special Topics in Optimization I* [25128]. In this case, the duration of the written examination takes 120 minutes.

Conditions
None.

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

Learning Outcomes
The student

- knows and understands the fundamentals of a special topic in continuous optimization,
- is able to choose, design and apply modern techniques of this special topic in continuous optimization in practice.

Content

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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

Course: Special Sociology [spezSoz]

Coordinators: G. Nollmann, Pfadenhauer, Haupt, Grenz, Eisewicht, Kunz, Dukat, Albrecht, Enderle
Part of the modules: Sociology (p. 156)[WI4SOZ1]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2	lecture	Winter / Summer Term	de

Learning Control / Examinations
The assessment conists of a gradedterm paper (according to Section 4 (2), 3 of the examination regulation.

Conditions
The form of the lecture has to be attended and must be completed with 2 Credit Points. The form of the lecture must not be swapped by a seminar according sociological theory, according techniques of social research or any other lecture.

Learning Outcomes
The student

- gains basic knowledge of a Special Sociology.
- gains knowledge of a specific problem in the Social Sciences.
- accordingly is capable of questioning further phenomena of the Social Sciences.
- is able to specify, pursue and explain own scientific questions.

Content
The student has the choice of the broad range of course offerings at the institute. In the course specific scientific problems and their debate will be introduced and dicussed.

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Media
Will be announced in the lecture.

Literature
Will be announced in the lecture.
Elective literature:
Will be announced in the lecture.

Course: Specific Aspects in Taxation [2560129]

Coordinators: B. Wigger, Armin Bader
Part of the modules: Advanced Topics in Public Finance (p. 76)[WI4VWL18]

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

Learning Control / Examinations
The assessment consists of an 1h written exam following Art. 4, para. 2, clause 1 of the examination regulation. The grade for this course equals the grade of the written exam.

Conditions
None.

Recommendations
Knowledge of the collection of public revenues is assumed. Therefore it is recommended to attend the course "Öffentliche Einnahmen" beforehand.

Learning Outcomes
See German version.

Content
The lecture „Special Aspects of Taxation" focuses on the effects of different taxes. The main emphasis is on German tax legislation. In addition to that, international aspects of taxation, in particular with respect to the European integration, will be discussed.
The lecture consists of four parts: First specific tax problems of corporate, income and consumption taxes are treated. Part two introduces the advantages and disadvantages of each of these taxes, in particular their incidence ("Who actually carries the tax burden?") and their effects within the value chain. The third part then deals with the question how the different taxes contribute to public revenues. Finally, the last part compares tax systems within and outside Europe.
As a special feature, guest lecturers will provide insight into practical aspects of taxation.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Elective literature:

- Andel, N. (1998): *Finanzwissenschaft*, 4th ed., Mohr Siebeck.
- Betsch, O., Groh, A.P. und Schmidt, K. (2000): *Gründungs- und Wachstumsfinanzierung innovativer Unternehmen*, Oldenbourg.
- Cloer, A. und Lavrelashvili, N. (2008): *Einführung in das Europäische Steuerrecht*, Schmidt Erich.
- Homburg, S.(2007) : *Allgemeine Steuerlehre*, 5th ed.,Vahlen.
- Kravitz, N. (Ed.) (2010) : *Internationale Aspekte der Unternehmensbesteuerung,* Journal of Business Economics, Special Issue 2/2010
- Scheffler, W. (2009) : *Besteuerung von Unternehmen I – Ertrags- Substanz- und Verkehrssteuern*, 11th ed., Müller Jur..
- Scheffler, W. (2009): *Besteuerung von Unternehmen II – Steuerbilanz*, 11th ed., Müller Jur..
- Wigger, B.U. (2006): *Grundzüge der Finanzwissenschaft*; 2nd ed., Springer.

Course: Track Guided Transport Systems - Technical Design and Components [6234701]

Coordinators: E. Hohnecker
Part of the modules: Track Guided Transport Systems / Engineering (p. 138)[WI4INGBGU27]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	3/1	lecture + exercise	Winter term	de

Learning Control / Examinations
See German version.

Conditions
See module description.

Learning Outcomes
See German Version.

Content
Law and Organisation of track guided transport systems, basics of driving dynamics, dimensioning and construction of railway tracks, basics of railway facilities, basics of signalling

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

Literature
Zilch, Diederichs, Katzenbach, Beckmann (Hrsg): Handbuch für Bauingenieure, Springer-Verlag 2012

Course: Standard Valuation in Public Transport-Example [6234904]

Coordinators: E. Hohnecker
Part of the modules: Project in Public Transportation (p. 136)[WI4INGBGU25]

ECTS Credits	Hours per week	Type	Term	Instruction language
1,5	1	exercise	Winter term	de

Learning Control / Examinations
The assessment of the lecture *"Standard Valuation" in public transport-example* [6234904] consists of an non exam assessment (an oral presentation following §4(2), 3 of the examination regulation.
The exam is offered each semester. The re-examination is offered upon prior agreement with the interested participants and not later than the next regular examination date.

Conditions
See module description.
The lecture is obligatory in the module *Project in Public Transportation*.

Recommendations
See module description.

Learning Outcomes
See German version.

Content
practise: urban traffic project: economic evaluation

Workload
The total workload for this course is approximately 45.0 hours. For further information see German version.

Remarks
See German version.

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. 84)[WI4OR5]

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

Learning Control / Examinations
The assessment consists of a written exam (120 min) according to Section 4 (2), 1 of the examination regulation.
The exam takes place in every semester.
Prerequisite for admission to examination is the succesful completion of the online assessments.

Conditions
Basic knowledge as conveyed in the module *Introduction to Operations Research* [WW1OR] is assumed.

Learning Outcomes
The student

- knows and describes basic quantitative methods in location planning in the context of strategic Supply Chain Planning,
- applies several criteria for the evaluation of the locations of facilities in the context of classical location planning models (planar models, network models and discrete models) and advanced location planning models designed for Supply Chain Management (single-period and multi-period models),
- implements the considered models in practical problems.

Content
Since the classical work "Theory of the Location of Industries" of Weber from 1909, the determination of an optimal location of a new facility with respect to existing customers is strongly connected to strategical logistics planning. Strategic decisions concerning the location of facilities as production plants, distribution centers or warehouses are of high importance for the rentability of supply chains. Thoroughly carried out, location planning allows an efficient flow of materials and leads to lower costs and increased customer service.
Subject of the course is an introduction to the most important terms and definitions in location planning as well as the presentation of basic quantitative location planning models. Furthermore, specialized location planning models for Supply Chain Management will be addressed as they are part in many commercial SCM tools for strategic planning tasks.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Elective literature:

- Daskin: Network and Discrete Location: Models, Algorithms, and Applications, Wiley, 1995
- Domschke, Drexl: Logistik: Standorte, 4. Auflage, Oldenbourg, 1996
- Francis, McGinnis, White: Facility Layout and Location: An Analytical Approach, 2nd Edition, Prentice Hall, 1992
- Love, Morris, Wesolowsky: Facilities Location: Models and Methods, North Holland, 1988
- Thonemann: Operations Management - Konzepte, Methoden und Anwendungen, Pearson Studium, 2005

Remarks
The lecture is held in every winter term. The planned lectures and courses for the next three years are announced online.

Course: [2521391]

Coordinators: M. Höchstötter
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations
The assessment is done according to §4(2), 3 of the examination regulation.
Students write a seminar paper on an assigned topic (10 to 12 pages), present it in class and discuss results during seminar sessions. These three elements are graded individually. The seminar grade is the weighted average of these individual grades. The weighting depends on the respective seminar.

Conditions
None.

Learning Outcomes

Content

Workload
The total workload for this course is approximately 90 hours.
Lecture 30h
Preparation of lecture 45h
Exam preparation 15h

Course: Statistical Methods in Financial Risk Management [2521353]

Coordinators: A. Nazemi
Part of the modules: Statistical Methods in Risk Management (p. 89)[WI4STAT2], Mathematical and Empirical Finance (p. 88)[WI4STAT1]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise		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
The student

- is familiar with probability distributions and stable distributions
- knows the estimation methodologies and Copulas,
- is able to model time series data,
- learns Value-at-Risk (VAR) and Asset-Liability Management, Stress testing and Risk Metrics,
- is familiar with portfolio optimization,
- knows Market risk, Credit risk and Operational risk,
- is familiar with Basel Regulations,
- Works with real financial data in R and Matlab.

Content
Part 1: Financial Risk Management: Risk Indicators at Instrumental Level; (Single Fixed Flow, Fixed Rate Bond, FRA, Interest Rate Futures, Interest Rate Swaps, FX Spot, FX Forward, Plain Vanilla Options), Credit Risk, Risk Indicators at the Portfolio Level (Pricing Environment, Interest Rate Factors, FX Factors), Value-at-Risk (VAR) and Asset-Liability Management, Risk Metrics - Market Risk in a Single Position, Measures of Market Risk: (Linear and Non-linear Positions), Market Risk Limits, Calibrating Valuation and Risk Models Performance Evaluation, Probability Distributions and Statistical Assumptions Forecasting Volatilities and Correlations (Basic Design, Ex-post Estimation, Ex-ante Estimation - Forecasting, Defining the Optimal Decay Factor), Assessing Performance (Univariate and Multivariate Tail Probabilities), Mathematics of Structures Monte Carlo (Generating Statistics, Properties of the Correlation Matrix), Mapping Algorithms (Fixed Income, Foreign Exchange, Commodities, Options). Models for Credit Risk. Introduction to Operational Risk
Part 2: Optimal portfolio management: portfolio construction, long/short investing, transaction costs and turnover, performance analysis, asset allocation, benchmark timing. Integrating the equity portfolio management process, active versus passive portfolio management, tracking error (backward-looking versus forward looking tracking error, the impact of portfolio size, benchmark volatility and portfolio betas on tracking error), equity style management (types of equity styles, style classification system), passive strategies(constructing an index portfolio, index tracking and cointegration), active investing (top-down and bottom-up approaches to active investing, fundamental law of active management, strategies based on technical analysis, technical analysis and statistical pattern recognition, market-neutral strategies and statistical arbitrage), Application of Multifactor Risk Models(Risk Decomposition, Portfolio construction and Risk Control, Assessing the exposure of a portfolio, Risk control against a stock-market index, Tilting a portfolio).

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Media
transparencies, exercises.

Literature

- Fat-Tailed and Skewed Asset Return Distributions: Implications for Risk Management, Portfolio selection, and Option Pricing, Rachev, S., Menn C. and Fabozzi F. , John Wiley, Finance, 2005
- Financial Optimization, by Stavros A. Zenios, 1993, Cambridge University Press.
- The Mathematics of Financial Modeling and Investment Management, by Sergio Focardi and Frank Fabozzi, 2004, Wiley

Remarks
URL: http://statistik.econ.kit.edu/

Course: Statistics and Econometrics in Business and Economics [2521325/2521326]

Coordinators: W. Heller
Part of the modules: Statistical Methods in Risk Management (p. 89)[WI4STAT2]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/2	lecture + exercise	Winter term	de

Learning Control / Examinations
See German version.

Conditions
Basic knowledge in statistics is required.

Learning Outcomes
statistically accurate use of financial market data, particularly time series analysis
Evaluation of various time series models and their applicability

Content
In Part 1 we will provide a thorough description of the quantitative part of investment theory paying attention to the mathematical, probabilistic and statistical methods now widely used in financial practice.
In Part 2 we shall study the methods of construction, identification and verification of te time-series models, which are among most powerful instruments of the financial econometrics. The emphasis will be on the financial and economic indicators forecasting the financial time-series.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
transparencies lecture

Literature
e.g.

- Franke/Härdle/Hafner : Einführung in die Statistik der Finanzmärkte.
- Ruppert: Statistics and Finance
- Cochran J.H. : Time Series for Macroeconomics and Finance

Elective literature:
See reading list

Course: Advanced Statistics [2550552]

Coordinators: O. Grothe
Part of the modules: Analytics and Statistics (p. 90)[WI4STAT4]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/2	lecture + exercise	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. The exam is offered every semester. Re-examinations are offered only for repeaters.

Conditions
None.

Learning Outcomes
Students

- cope with advanced fundamentals of statistics as well as simulation methods
- know the fundamentals of point and interval estimation as well as testing of hypotheses,
- perform special parametric and nonparametric estimations and tests,
- analyse stochastic processes.

Content

- Moment generating and characteristic function
- Types of convergence and limit theorems
- Simulation techniques
- Estimation and testing
- Stochastic processes

Workload
The total workload for this course is approximately 135 hours.
Lecture: 60 hours
Preparation of lecture: 45 hours
Exam preparation: 30 hours

Remarks
New course starting winter term 2015/2016

Course: Statistical Modeling of generalized regression models [2521350]

Coordinators: W. Heller
Part of the modules: Econometrics and Statistics II (p. 92)[WI4STAT6], Econometrics and Statistics I (p. 91)[WI4STAT5]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/2	lecture + exercise	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.

Conditions
None.

Recommendations
Knowledge of the contents covered by the course "Economics III: Introduction in Econometrics" [2520016]

Learning Outcomes
The student

- shows comprehensive knowledge of regression techniques

Content

Workload
The total workload for this course is approximately 135 hours (4.5 credits).
regular attendance: 30 hours
self-study: 65 hours
exam preparation: 40 hours

Media
Slides

Literature
Provided in the lecture

Course: Tax Law I [24168]

Coordinators: D. Dietrich
Part of the modules: Private Business Law (p. 153)[WI4JURA5], Governance, Risk & Compliance (p. 155)[WI4JURGRC]

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

Learning Control / Examinations
The assessment consists of a written exam (approx. 45 minutes) according to section 4 subsection 2 no. 1 study and examination regulations.

Conditions
None.

Learning Outcomes
The target of the lecture is an introduction to national business tax law. The legal norms, spread on several individual tax laws, which are decisive for the taxation of the companies and their owners, will be treated. The focus is on basic fiscal knowledge realizable in practice as a component of modern business economics.

Content
Except for a basic knowledge of the existing German company types and the annual financial statements (balance sheet, statement of earnings), no fiscal previous knowledge is required. The lecture intends to give a current global overview about the most important elements of law. The focus is on trade or business companies in the most common forms such like sole traders, partnerships and corporations.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
transparancies

Literature

- Grashoff Steuerrecht, Verlag C. H. Beck, last edition
- Tipke/Lang Steuerrecht, Verlag C. H. Beck, last edition

Course: Tax Law II [24646]

Coordinators: D. Dietrich
Part of the modules: Private Business Law (p. 153)[WI4JURA5]

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

Learning Control / Examinations
The assessment consists of a written exam following §4, Abs. 2, 1 of the SPO.

Conditions
None.

Learning Outcomes
It is the target of the lecture to provide extended knowledge in business administration related theory of taxation in the field of economics and law, based on the general lecture "introduction to corporate tax law". The students obtain the basis for an economic examination of the fiscal prescriptions and are able to assess the impact on business decisions. The emphasis is on such tax law regulations which allow possibilities for action and decision to the taxpayer.

Content
The lecture requires basic knowledge of commercial law and company law as well as of earnings tax law. Basic and current questions of German corporate taxation are systematically prepared in topic blocs; foils, leaflets and supplementary references are distributed in the individual sessions. There is room for discussion. A recent text collection of the tax laws will be necessary.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
transparancies

Literature

- Grashoff, Steuerrecht, Verlag C.H. Beck, latest edition.
- Spangemacher, Gewerbesteuer, Band 5, Grüne Reihe, Erich Fleischer Verlag
- Falterbaum/Bolk/Reiß/Eberhart, Buchführung und Bilanz, Band 10, Grüne Reihe, Erich Fleischer Verlag
- Tipke, K./Lang, J., Steuerrecht, Köln, in der neuesten Auflage.
- Jäger/Lang Körperschaftsteuer, Band 6, Grüne Reihe, Erich Fleischer Verlag
- Lippross Umsatzsteuer, Band 11, Grüne Reihe, Erich Fleischer Verlag
- Plückebaum/Wendt/ Niemeier/Schlierenkämper Einkommensteuer, Band 3, Grüne Reihe, Erich Fleischer Verlag

Course: Control Technology [2150683]

Coordinators: C. Gönnheimer
Part of the modules: Specialization in Production Engineering (p. 101)[WI4INGMB22]

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

Learning Control / Examinations
The assessment consists of an oral exam taking place during the recess period (according to Section 4(2), 2) of the examination regulation).
The examination takes place every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None

Recommendations
None

Learning Outcomes
The students . . .

- are able to name the electrical controls which occur in the industrial environment and explain their function.
- can explain fundamental methods of signal processing. This involves in particular several coding methods, error protection methods and analog to digital conversion.
- are able to choose and to dimension control components, including sensors and actors, for an industrial application, particularly in the field of plant engineering and machine tools. Thereby, they can consider both, technical and economical issues.
- can describe the approach for projecting and writing software programs for a programmable logic control named Simatic S7 from Siemens. Thereby they can name several programming languages of the IEC 1131.

Content
The lecture control technology gives an integral overview of available control components within the field of industrial production systems. The first part of the lecture deals with the fundamentals of signal processing and with control peripherals in the form of sensors and actors which are used in production systems for the detection and manipulation of process states. The second part handles with the function of electric control systems in the production environment. The main focus in this chapter is laid on programmable logic controls, computerized numerical controls and robot controls. Finally the course ends with the topic of cross-linking and decentralization with the help of bus systems.
The lecture is very practice-oriented and illustrated with numerous examples from different branches.
The following topics will be covered

- Signal processing
- Control peripherals
- Programmable logic controls
- Numerical controls
- Controls for industrial robots
- Process control systems
- Field bus
- Trends in the area of control technology

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).

Literature
Lecture Notes

Remarks
None

Course: Stochastic Calculus and Finance [2521331]

Coordinators: M. Safarian
Part of the modules: Econometrics and Statistics II (p. 92)[WI4STAT6], Mathematical and Empirical Finance (p. 88)[WI4STAT1]

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

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

Conditions
None.

Learning Outcomes
After successful completion of the course students will be familiar with many common methods of pricing and portfolio models in finance. Emphasis we be put on both finance and the theory behind it.

Content
The course will provide rigorous yet focused training in stochastic calculus and finance. The program will cover modern approaches in stochastic calculus and mathematical finance. Topics to be covered:

1. Stochastic Calculus. Stochastic Processes, Brownian Motion and Martingales, Stopping Times, Local martingales, Doob-Meyer Decomposition, Quadratic Variation, Stochastic Integration, Ito Formula, Girsanov Theorem, Jump-diffusion Processes. Stable and tempered stable processes. Levy processes.
2. Mathematical Finance: Pricing Models. The Black-Scholes Model, State prices and Equivalent Martingale Measure, Complete Markets and Redundant Security Prices, Arbitrage Pricing with Dividends, Term-Structure Models (One Factor Models, Cox-Ingersoll-Ross Model, Affine Models), Term-Structure Derivatives and Hedging, Mortgage-Backed Securities, Derivative Assets (Forward Prices, Future Contracts, American Options, Look-back Options), Option pricing with tempered stable and Levy-Processes and volatility clustering, Optimal Portfolio and Consumption Choice (Stochastic Control and Merton continuous time optimization problem), Equilibrium models, Consumption-Based CAPM, Numerical Methods.

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

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: Markov Decision Models I [2550679]

Coordinators: K. Waldmann
Part of the modules: Stochastic Modelling and Optimization (p. 87)[WI4OR7]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1/2	lecture + exercise + tutorial	Winter term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following Section 4(2), 1 of the examination regulation. Credit from the voluntary computer lab is accounted for in the overall grade raising the exam grade by a 2/3 step of a full grade (according to Section 4(2), 3 of the examination regulation).

Conditions
None.

Learning Outcomes
The participants will be enabled to model and analyze stochastic systems with modern techniques. The discussion of practice-oriented case studies pursues two goals. On the one hand, typical problem settings are illustrated and on the other hand, criteria for the evaluation of the performance of stochastic systems are motivated. Properties and characteristics for the evaluation of the performance of Markov Chains, Poisson Processes and queuing systems are developed.

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

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Media
Blackboard, Slides, Flash Animations, Simulation Software

Literature

- Waldmann, K.H., Stocker, U.M. (2012): Stochastische Modelle - eine anwendungsorientierte Einführung, Springer, 2. Auflage
- Elective literature:
  - Norris, J.R. (1997): Markov Chains; Cambridge University Press
  - Bremaud, P. (1999): Markov Chains, Gibbs Fields, Monte Carlo Simulation and Queues, Springer

Course: Markov Decision Models II [2550682]

Coordinators: K. Waldmann
Part of the modules: Stochastic Modelling and Optimization (p. 87)[WI4OR7]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1/2	lecture + exercise + tutorial	Summer term	de

Learning Control / Examinations
The assessment consists of an 1h written exam following Section 4(2), 1 of the examination regulation. Credit from the voluntary computer lab is accounted for in the overall grade raising the exam grade by a 2/3 step of a full grade (according to Section 4(2), 3 of the examination regulation).

Conditions
Foundations in the field of the Markov Decision Models I [2550679] are desired.

Learning Outcomes
The participants will be enabled to utilize Markov Decision Processes as a method for analyzing, controlling and optimizing dynamic stochastic systems. The discussion of practice-oriented case studies in the area of the management of energy systems, revenue management and logistics illustrates the application fields of Markov Decision Processes. Necessary mathematical concepts like theoretical foundations, optimality criteria and the solution of the optimality equation are presented.
Particularly the development of simple structured decision rules, that are desired by practitioners on the one hand, and that permit the efficient solutions of the optimality equation on the other hand, are discussed. The facultative computer exercise course using the programming language Java comprises a practice-oriented case study that illustrates the opportunities of the optimization of stochastic systems.

Content
Queuing Systems, Stochastic Decision Processes

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Blackboard, Slides, Flash Animations, Simulation Software

Literature

- Waldmann, K.H., Stocker, U.M. (2012): Stochastische Modelle - eine anwendungsorientierte Einführung, Springer, 2. Auflage
- Elective literature: Puterman, M.L. (1994): Markov Decision Processes: Discrete Stochastic Dynamic Programming; John Wiley

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

Course: Mass Fluxes [6223701]

Coordinators: S. Fuchs
Part of the modules: Environmental Management (p. 132)[WI4INGBGU14]

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

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

Conditions
None.

Recommendations
Attendance to the course *Siedlungswasserwirtschaft* [0170603] is recommended.

Learning Outcomes
The course:

- provides a deep understanding of mass fluxes in natural and man-made (technical) systems
- examines the needs for management and details efficient measures and technologies

Content
Introduction to the principles of mass fluxes and system analysis:

- definition and classification of systems
- Mass balance equation as a basic tool for system description
- Introduction of ideal reactors and mathematical models to represent complex processes
- Examples

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Lecture notes

Literature
Imboden, D. & Koch, S. (2003): *Systemanalyse – Einführung in die mathematische Modellierung natürlicher Systeme*. 2. Auflage, Springer-Verlag.
Bossel, H. (1994): *Modellbildung und Simulation - Konzepte, Verfahren und Modelle zum Verhalten dynamischer Systeme*. 2. Auflage, Vieweg Verlag.
Richtlinie 2008/105/EG des Europäischen Parlaments und des Rates vom 16. Dezember 2008 über Umweltqualitätsnormen im Bereich der Wasserpolitik

Course: Traffic Engineering [6232703]

Coordinators: P. Vortisch
Part of the modules: Transportation Modelling and Traffic Management (p. 134)[WI4INGBGU16]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	1/1	lecture + exercise	Winter term	de

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

Conditions
See module description.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Strategic Brand Management [2571185]

Coordinators: M. Klarmann, J. Blickhäuser
Part of the modules: Marketing Management (p. 51)[WI4BWLMAR5]

ECTS Credits	Hours per week	Type	Term	Instruction language
1,5	1/0	lecture + exercise	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

Workload
The total workload for this course is approximately 45.0 hours. For further information see German version.

Remarks
For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).
Please note: The number of participants for this course is limited. The Marketing & Sales Research Group typically provides the possibility to attend a course with 1,5 ECTS in the respective module to all students. Participation in a specific course cannot be guaranteed.

Course: Strategical Aspects of Energy Economy [2581958]

Coordinators: A. Ardone
Part of the modules: Energy Economics and Technology (p. 50)[WI4BWLIIP5]

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

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

Conditions
None.

Learning Outcomes
Students

- have in-depth knowledge of current and future technologies for power generation,
- know methods and approaches regarding short- to long-term electricity system planning and market modeling - in particular the cost of generating electricity.

Content
1) Energy supply
1.1 Basic concepts
1.2 Global supply & demand (oil, coal, gas, electricity)
2) Power plant types
2.1 Thermal power plants
2.2 Renewables
3) Cost of electricity generation
3.1 Cost depending on the investment (CAPEX)
3.2 Operational fixed cost (OPEX)
3.3 Variable cost
3.4 Full cost of power generation
4) Electricity markets
4.1 Development of power markets
5) Energy system planning
5.1 basic concepts
5.2 Drivers
5.3 Stages of power planning
5.4 Short-term optimization: dispatch decisions
5.5 Mid-term optimization: fuel procurement and overhaul planning
5.6 Long-term optimization: additions & Retirements
5.7 Mathematical tools for system planning and market modeling

Workload
The total workload for this course is approximately 105.0 hours. For further information see German version.

Literature
Will be anounced in the lecture.

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

Coordinators: B. Neibecker
Part of the modules: Marketing Management (p. 51)[WI4BWLMAR5], Strategy, Communication, and Data Analysis (p. 54)[WI4BWLMAR7]

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

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

Conditions
See corresponding module information.

Learning Outcomes
Students have learned the following outcomes and competences:
- To specify the key terms in strategic management and innovation research, based on methodological and behavioral approaches
- To apply statistical tools to analyze and interpret strategic problems in marketing
- To indentify the main research trends
- To analyze and interpret high level academic articles
- To learn interactive skills to work in teams and to follow a goal-oriented approach
- To gain understanding of methodological research to develop concrete plans for marketing decision-making

Content
The course places emphasis on the role of marketing in strategic planning. The planning and implementation stages are discussed using a case study in business portfolio analysis, talking about experience effects, approaches in defining strategic business units. A critical view on market orientation as a source of sustainable competitive advantage is given. Further topics are innovation and diffusion models, behavioral approaches to innovative decision processes and a discussion on Porter's single diamond theory and globalization.

Workload
The total workload for this course is approximately 140.0 hours. For further information see German version.

Literature

- Backhaus, K. und M. Voeth: Industriegütermarketing. München: Vahlen 2010.
- Cestre, G. und R. Y. Darmon: Assessing consumer preferences in the context of new product diffusion. In: International Journal of Research in Marketing 15, 1998, 123-135.
- Dunning, J. H.: Internationalizing Porter's Diamond. In: mir Management International Review, Special Issue 1993/2, 7-15.
- Gatignon, H. und T. S. Robertson: Innovative Decision Processes. In: Robertson T. S. und H. H. Kassarjian (Hrsg.), Handbook of Consumer Behavior, Englewood Cliffs: Prentice-Hall 1991.
- Homburg, C. und H. Krohmer: Marketingmanagement. Wiesbaden: Gabler 2009.
- 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 Transport Planning [6232808]

Coordinators: V. Waßmuth
Part of the modules: Transportation Modelling and Traffic Management (p. 134)[WI4INGBGU16], Fundamentals of Transportation (p. 133)[WI4INGBGU15]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

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

Conditions
See module description.

Learning Outcomes
See German version.

Content

Workload

Course: Strategic Management of Information Technology [2511602]

Coordinators: T. Wolf
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Summer term	de

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

Conditions
None.

Learning Outcomes
Students know the outer frame of IT in an enterprise and know which functions IT has within an enterprise. They unterstand the organization and the content of these functions.

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

Workload

Aktivität		h
Präsenzzeit		
Lecture	(7 x 4 x 45 min)	24h 0min
Preparation of exercise	(4 x 3h)	12h 0min
execise	(4 x 3h)	12h 0min
Preparation presentation	(4 x 3h)	12h 0min
script repetition (2x)	(2 x 24h)	48h
calculation of 1 exam	(1 x 1h)	1 h 0 min
exam preparation		44 h
Sum:		150 h

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
- Österle, H. et al.: Unternehmensführung und Informationssystem. Teubner, Stuttgart 1992
- Thome, R.: Wirtschaftliche Informationsverarbeitung. Verlag Franz Vahlen, München 1990

Course: Structural and phase analysis [2125763]

Coordinators: S. Wagner
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

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

Learning Control / Examinations
oral
20 min
auxiliary means: none

Conditions
None.

Learning Outcomes
The students know the fundamentals of crystallography, the generation and detection of x-rays as well as their interaction with the microstructure of crystalline materials. They have detailed knowledge about the different methods of x-ray diffraction measurements and are able to analyse x-ray spectra using modern methods of x-ray analysis both qualitatively and quantitatively.

Content
The course gives an overview to generation and detection of x-rays as well as their interaction with matter. It provides an introduction to crystallography and describes modern measurement and analysis methods of x-ray diffraction.
It is arranged in the following units:

- Generation and properties of X-Ray's
- Crystallography
- Fundamentals and application of different measuring methods
- Qualitative and quantitative phase analysis
- Texture analysis (pole figures)
- Residual stress measurements

Workload
The total workload for this course is approximately 120 hours.
regular attendance: 30 hours
self-study: 90 hours

Media
Slides for the lecture:
available unter http://ilias.studium.kit.edu

Literature

1. Moderne Röntgenbeugung - Röntgendiffraktometrie für Materialwissenschaftler, Physiker und Chemiker, Spieß, Lothar / Schwarzer, Robert / Behnken, Herfried / Teichert, Gerd B.G. Teubner Verlag 2005
2. H. Krischner: Einführung in die Röntgenfeinstrukturanalyse. Vieweg 1990.
3. B.D. Cullity and S.R. Stock: Elements of X-ray diffraction. Prentice Hall New Jersey, 2001.

Course: Structural Ceramics [2126775]

Coordinators: M. Hoffmann
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

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

Learning Control / Examinations
The assessment consists of an oral exam (20-30 min) taking place at a specific date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered at a specific date.

Conditions
None.

Recommendations
Basic knowledge of experimental physics and chemistry is recommended.
It is recommended to attend the course *Ceramics-Introduction* [2125757].

Learning Outcomes
The students know the most relevant structural ceramics (silicon carbide, silicon nitride, alumina, boron nitride, zirconia, fibre-reinforced ceramics) and their applications. They are familar with the microstructural features, fabrication methods, and mechanical properties.

Content
The lecture gives an overview on structure and properties of the technical relevant structural ceramics silicon nitride, silicon carbide, alumina, zirconia, boron nitride and fibre-reinforced ceramics. All types of structural ceramics will be discussed in detail in terms of preparation methods of the raw materials, shaping techniques, densification, microstructural development, mechanical properties and application fields.

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
Slides for the lecture:
available under http://ilias.studium.kit.edu

Literature
W.D. Kingery, H.K. Bowen, D.R. Uhlmann, “Introduction to Ceramics”, John Wiley & Sons, New York, (1976)

E. Dörre, H. Hübner, “Aluminia”, Springer Verlag Berlin, (1984)

M. Barsoum, “Fundamentals of Ceramics”, McGraw-Hill Series in Material Science and Enginewering (2003)

Remarks
The course will not take place every year.

Course: Superhard Thin Film Materials [2177618]

Coordinators: S. Ulrich
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

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

Learning Control / Examinations
The assessment consists of an oral exam (30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered upon agreement.

Conditions
None

Recommendations
Basic knowledge of physics, chemistry and material science is assumed.
The module *Emphasis Material Science* [WI3INGMB9] should be completed successfully beforehand.

Learning Outcomes
Superhard materials are solids with a hardness higher than 4000 HV 0,05. The main topics of this lecture are modelling, deposition, characterization and application of superhard thin film materials.

Content
Introduction

Basics

Plasma diagnostics

Particle flux analysis

Sputtering and ion implantation

Computer simulations

Properties of materials, thin film deposition technology,
thin film analysis and modelling of superhard materials

Amorphous hydrogenated carbon

Diamond like carbon

Diamond

Cubic Boronnitride

Materials of the system metall-boron-carbon-nitrogen-silicon

Workload
regular attendance: 22 hours
self-study: 98 hours

Literature
G. Kienel (Ed.): Vakuumbeschichtung 1 - 5, VDI Verlag, Düsseldorf, 1994

Copies with figures and tables will be distributed

Course: Supply chain management [2117062]

Coordinators: K. Alicke
Part of the modules: Logistics in Value Chain Networks (p. 108)[WI4INGMB28]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	3/1	lecture + exercise	Winter term	de

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

Conditions
See german version.

Recommendations
None.

Learning Outcomes
Students are able to:

- Discuss the requirements on modern supply chains,
- Use the basic concepts of demand forecast, stock optimization and supply in practical exercises,
- Analyse the typical questions of dimensioning a supply chain and evaluate a supply chain with the results.

Content

- Bullwhip-Effect, Demand Planning & Forecasting
- Conventional planning processes (MRP + MRPII)
- Stock keeping strategy
- Data acquisition and analysis
- Design for logistics (Postponement, Mass Customization, etc.)
- Logistic partnerships (VMI, etc.)
- Distribution structures (central vs. distributed, Hub&Spoke)
- SCM-metrics (performance measurement) e-business
- Special sectors as well as guest lectures

Workload
regular attendance: 42 hours
self-study: 138 hours

Media
presentations

Literature
Alicke, K.: Planung und Betrieb von Logistiknetzwerken

Simchi-Levi, D., Kaminsky, P.: Designing and Managing the Supply Chain

Goldratt, E., Cox, J.: The Goal

Remarks
this course is not offered at the moment
this course is a block course

Course: Supply Chain Management in the automotive industry [2581957]

Coordinators: T. Heupel, H. Lang
Part of the modules: Industrial Production III (p. 47)[WI4BWLIIP6]

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

Learning Control / Examinations
The examination will be in form of a written exam acc. to §4(2), 1 ER. Exams are offered in every semester and can be re-examined at every ordinary examination date.

Conditions
None.

Recommendations
None.

Learning Outcomes
Students are taught knowledge, methods and tools in the field of automotive supply chain management. With the help of concrete examples of a global automotive company, they acquire a basic understanding of challenges in the implementation of those solutions. Students learn about theoretic concepts and their transfer to practice in designing value-added structures, procurement logistics, risk management, quality engineering, cost engineering, and purchasing. They are able to identify, analyze and assess problems and to design adequate solutions within those aspects. In the end of the lecture, students can integrate the aspects into the general context of automotive supply chain management and development process.

Content

- Automotive industry significance
- The automotive supply chain
- Adding value structures of the automotive supply chain and mastering of the production systems as factors of success in the SCM
- Strategic procurement logistics
- Risk management
- Quality engineering and management in the automotive supply chain
- Cost engineering and management in the automotive supply chain
- Purchasing (Supplier selection, contract management)
- Performance measurement of the supply chain / organization

Workload
The total workload for this course is approximately 105.0 hours. For further information see German version.

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

Literature
Will be announced in the course.

Remarks
None.

Course: Supply Chain Management in the Process Industry [2550494]

Coordinators: S. Nickel
Part of the modules: Operations Research in Supply Chain Management and Health Care Management (p. 84)[WI4OR5]

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

Learning Control / Examinations
The assessment is a 60 minutes written examination (according to §4(2), 1 of the examination regulation) (individual grading), case study presentation by student teams (team grading) and classroom participation (individual grading). The examination is held in the term of the lecture.

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

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

Learning Outcomes
The student

- knows and classifies state-of-the art approaches for designing, planning and managing global supply chains in the process industry
- distingusihes quality in supply chains and identifies important building blocks, repeating patterns and concepts crucial to supply chain strategy, design and planning,
- explains specific challenges and approaches towards supply chain operations within the process industry with regards to transportation and warehousing, and describes the interdisciplinary linkage of SCM with information systems, performance management, project management, risk management and sustainability management,
- transfers gained knowledge into practice by using SCM case studies and SCM real life project documentations.

Content
The course "Supply Chain Management in the Process Industry" covers fundamental concepts in the field of supply chain management with special focus on process industry. Strategic, planning and operational topics within the end-to-end supply chain are examined, covering relevant approaches in design, processes and performance measurement. Additional focus within the course is on showing the interdisciplinary linkages SCM has with information systems, performance management, project management, risk management and sustainability management. The course is enriched by various insights from the world´s leading chemical company BASF, provided by executive management as real life examples and cases.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature

- Chopra, S./Meindl, P.: Supply Chain Management – Strategy, Planning, & Operations, 4th edition, Upper Saddle River, 2009.
- Various case studies, which will be provided during the course

Remarks
The number of participants is restricted due to the execution of interactive case studies and the resulting examination effort. Due to these capacity restrictions, registration before course start is required according to the information on the course website. The course is planned to be held every winter term. The planned lectures and courses for the next three years are announced online.

Course: Supply Chain Management with Advanced Planning Systems [2581961]

Coordinators: M. Göbelt, C. Sürie
Part of the modules: Industrial Production III (p. 47)[WI4BWLIIP6]

ECTS Credits	Hours per week	Type	Term	Instruction language
3,5	2	lecture	Summer term	en

Learning Control / Examinations
The assessment consists of an oral (30 minutes) or a written (60 minutes) exam (following §4(2), 1 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Learning Outcomes
This lecture deals with supply chain management from a practitioner's perspective with a special emphasis on the software solution SAP SCM and the planning domain. First, the term supply chain management is defined and its scope is determined. Methods to analyze supply chains as well as indicators to measure supply chains are derived. Second, the structure of an APS (advanced planning system) is discussed in a generic way. Later in the lecture, the software solution SAP SCM is mapped to this generic structure. The individual planning tasks and software modules (demand planning, supply network planning, production planning / detailed scheduling, transportation planning / vehicle scheduling, global available-to-promise) are presented by discussing the relevant business processes, providing academic background, describing planning processes for a fictive company and showing the user interface and user-related processes in the software solution.
The lecture is supported by a self-explanatory tutorial, in which students can explore the software solution for the fictive company offline on their own.

Content
1. **Introduction to Supply Chain Management**
1.1. Supply Chain Management Fundamentals
1.2. Supply Chain Management Analytics
2. Structure of Advanced Planning Systems
3. SAP SCM
3.1. Introduction / SCM Solution Map
3.2. Demand Planning
3.3. Supply Network Planning
3.4. Production Planning and Detailed Scheduling
3.5. Deployment
3.6. Transportation Planning and Vehicle Scheduling
3.7. [Optional] Global Available to Promise
4. SAP SCM in Practice
4.1. Success Stories
4.2. SAP Implementation Methodology

Workload
The total workload for this course is approximately 105 hours. For further information see German version.

Remarks
This lecture has 3,5 Credits since summer term 2014.

Course: Systematic Materials Selection [2174576]

Coordinators: J. Hoffmeister
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Summer term	de

Learning Control / Examinations
The assessment consists of a written exam (3h) (following §4(2), 1 of the examination regulation).

Conditions
The course *Material Science I* [21760] has to be completed beforehand.

Recommendations
Basic knowledge of natural science and knowledge of the content *Material Science II* [21782] is recommended.

Learning Outcomes
The students are able to select the best material for a given application. They are proficient in selecting materials on base of performance indices and materials selection charts. They can identify conflicting objectives and find sound compromises. They are aware of the potential and the limits of hybrid material concepts (composites, bimaterials, foams) and can determine whether following such a concept yields a useful benefit.

Content
Important aspects and criteria of materials selection are examined and guidelines for a systematic approach to materials selection are deeloped. The following topics are covered:

- Information and introduction
- Necessary basics of materials
- Selected methods / approaches of the material selection
- Examples for material indices and materials property charts
- Trade-off and shape factors
- Sandwich materials and composite materials
- High temperature alloys
- Regard of process influences
- Material selection for production lines
- Incorrect material selection and the resulting consequences
- Abstract and possibility to ask questions

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Literature
Lecture notes; Problem sheets; Textbook: M.F. Ashby, A. Wanner (Hrsg.), C. Fleck (Hrsg.);
Materials Selection in Mechanical Design: Das Original mit Übersetzungshilfen
Easy-Reading-Ausgabe, 3. Aufl., Spektrum Akademischer Verlag, 2006
ISBN: 3-8274-1762-7

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. 84)[WI4OR5]

ECTS Credits	Hours per week	Type	Term	Instruction language
4,5	2/1	lecture + exercise	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
Basic knowledge as conveyed in the module *Introduction to Operations Research* [WI1OR] is assumed.

Learning Outcomes
The student

- gathers expertise in fundamental techniques from procurement and distribution logistics, methods from inventory management and lot sizing,
- acquires the ability to efficiently utilize quantitative models from transportation planning (long-distance and distribution planning), inventory management and lot sizing in production,
- applies the introduced methods in more detail and in industry-relevant case-studies.

Content
The planning of material transport is an essential element of Supply Chain Management. By linking transport connections across different facilities, the material source (production plant) is connected with the material sink (customer).
The general supply task can be formulated as follows (cf. Gudehus): For given material flows or shipments, choose the optimal (in terms of minimal costs) distribution and transportation chain from the set of possible logistics chains, which asserts the compliance of delivery times and further constraints. The main goal of the inventory management is the optimal determination of order quantities in terms of minimization of fixed and variable costs subject to resource constraints, supply availability and service level requirements. Similarly, the problem of lot sizing in production considers the determination of the optimal amount of products to be produced in a time slot.
The course includes an introduction to basic terms and definitions of Supply Chain Management and a presentation of fundamental quantitative planning models for distribution, vehicle routing, inventory management and lot sizing. Furthermore, case studies from practice will be discussed in detail.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Elective literature:

- Domschke: Logistik: Transporte, 5. Auflage, Oldenbourg, 2005
- Domschke: Logistik: Rundreisen und Touren, 4. Auflage, Oldenbourg, 1997
- Ghiani, Laporte, Musmanno: Introduction to Logistics Systems Planning and Control, Wiley, 2004
- Gudehus: Logistik, 3. Auflage, Springer, 2005
- Simchi-Levi, Kaminsky, Simchi-Levi: Designing and Managing the Supply Chain, 3rd edition, McGraw-Hill, 2008
- Silver, Pyke, Peterson: Inventory management and production planning and scheduling, 3rd edition, Wiley, 1998

Remarks
The lecture is held in every summer term. The planned lectures and courses for the next three years are announced online.

Course: Technology Assessment [2545017]

Coordinators: D. Koch
Part of the modules: Innovation Management (p. 58)[WI4BWLENT2]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar	Summer term	de

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Recommendations
Prior attendance of the course *Innovation Management* [2545015] is recommended.

Learning Outcomes
The students

- look critically into current research topics in the field of technology evaluation,
- cultivate the economic discussion of research approaches,
- do literature search based on a given topic, identify relevant literature and evaluate this literature,
- give presentations in a scientific context in front of an auditorium to present the results of the research,
- present results of the research in a seminar thesis as a scientific publication

Content
Technology Assessment can play a role at different points in the innovation process and support decisions for or against specific technology options. The seminar "Technology Assessment" focuses on the early phase or fuzzy front end of innovation management. Technology assessment is done here with a certain degree of uncertainty concerning future technology developments. Technology assessment can be connected to the use of methods such as scenario analysis or roadmapping but also to the classical generation of ideas. Different methods and approaches are discussed in the seminar, for example, market-technology portfolios etc. The early assessment of technologies is assigned particular importance given the limited resources in companies and uncertainty about future developments.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Slides.

Course: Technologies for Innovation Management [2545018]

Coordinators: D. Koch
Part of the modules: Innovation Management (p. 58)[WI4BWLENT2]

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

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Recommendations
Prior attendance of the course *Innovation Management* [2545015] is recommended.

Learning Outcomes
The students

- look critically into current research topics in the field of using Technologies in Innovation Management,
- cultivate the economic discussion of research approaches,
- do literature search based on a given topic, identify relevant literature and evaluate this literature,
- give presentations in a scientific context in front of an auditorium to present the results of the research,
- present results of the research in a seminar thesis as a scientific publication.

Content
Technologies in innovation management can play a role at different points in the innovation process and support experts working in R&D contexts. The seminar "Technologies for Innovation Management" focuses on the early phase or fuzzy front end of innovation management. Technologies can be very important here, above all regarding the supply of information. In globally distributed R&D organizations, it is necessary to compile as much information about emerging technology developments as possible in the early phase of the innovation process. Information and communication technologies can be useful here. In this seminar, different technologies will be analyzed in terms of their usefulness for the early phase of innovation management from email through web 2.0 and social networks up to text mining and big data technologies etc.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Slides.

Course: Technological Change in Energy Economics [2581000]

Coordinators: M. Wietschel
Part of the modules: Energy Economics and Technology (p. 50)[WI4BWLIIP5]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2/0	lecture	Winter term	de

Learning Control / Examinations
The assessment consists of a written exam.

Conditions
None.

Learning Outcomes
The student

- has an understanding of innovation theory, innovation economy, and innovation systems,
- has skills in different quantitative method for the forecast of technology change in the energy sector, such as technology cycle models, optimization and simulation models as well as indicators and is able to select the adequate approach depending from the task,
- is able to evaluate most important technological developments in the energy sector (energy supply, energy demand, alternative fuels and propulsion systems in the transport sector, and infrastructure (storage, grids)) from a techno-economic perspective.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Telecommunication and Internet Economics [2561232]

Coordinators: K. Mitusch
Part of the modules: Network Economics (p. 65)[WI4VWL4], Electronic Markets (p. 39)[WI4BWLISM2]

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

Learning Control / Examinations
Result of success is made by a 60 minutes written examination during the semester break (according to §4(2), 1 ERSC). Examination is offered every semester and can be retried at any regular examination date.

Conditions
None.

Recommendations
Basic knowledge and skills of microeconomics from undergraduate studies (bachelor's degree) are expected.
Particularly helpful but not necessary: Industrial Economics. Prior attendance of the lecture „Competition in Networks" [26240] or "Industrial Organisation" is helpful in any case but not considered a formal precondition. The english taught course "Communications Economics" is complementary and recommendet for anyone interested in the sector.

Learning Outcomes
The students

- will know economically relevant technological and organization characteristics of telecommunication networks - fixed and mobile - as well as of the internet
- will understand the complex competition processes in the telecommunication and internet sector
- will be able to analyse these competitive processes by means of analytic instruments and to assess current debates on economic and regulation policies

The lecture is suited for all students who will deal with these sectors in their professional life.

Content
Among the network sectors the telecommunication and internet sector is the most dynamic one and the one with and highest variety of phenomena. Problems of natural monopoly still exist in some parts. But there is also competition, not only at the service level but also at the infrastructural level. Both levels are characterized by (vertical) quality differentiations and by high technology dynamics. What should the regulation of this sector look like? How should the mutual network access prices of two telecommunication providers be regulated and how can regulators set incentives for infrastructure investments?
The internet is a free market par excellence, because everybody can open internet businesses without high entry costs. Why then can a company like ebay dominate the market for internet-auction platforms so strongly? The causes of market concentration on the internet will be analyzed. So will be the economic implications of the Next Generations Networks.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
J.-J. Laffont, J. Tirole (2000): Competition in Telecommunications, MIT Press.
Further literature will be provided during the lecture

Course: Telecommunications Law [24632]

Coordinators: G. Sydow
Part of the modules: Public Business Law (p. 154)[WI4JURA6]

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

Learning Control / Examinations
The assessment consists of an written exam (approx. 60 min.) according to § 4(2), 1 SPO.

Conditions
None.

Recommendations
Parallel to the lectures tutoria are offered in which legal thinking and argumentation is practised. Their attendance is strongly recommended.
During the semester, test exams to each lecture are offered with extensive coaching. During the lecture-free time, a Q-and-A-lecture is offered.Details on the homepage of the ZAR (www.kit.edu/zar)

Learning Outcomes
Telecommunications is the technical basis of the Information Engineering and Management. In which way for example UMTS is regulated, is of relevant importance for the supply of services in the world of the mobile contents services. The central defaults of the telecommunications regulation are in the telecommunications law (TKG). This was completely amended due to community-legal defaults 2004. The lecture procures for apprehending the basics of legal framework of the information society the essential knowledge in telecommunication law.

Content
The lecture offers an overview of the new TKG. The whole range of the regulation is treated: Of the material-legal instruments of the competition-creative economic regulation (market -, entrance -, payment regulation as well as special supervision of abuse) and the non-economic regulation (customer protection; Broadcasting; Assignment of frequencies, numbers and rights of way; secrecy of telecommunications; Data security and public security) up to the institutional arrangement of the regulation. To assist in the understanding the technical and economic bases are clarified as well as community and constitutional default sat at the beginning of the lecture.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
extensive script with cases; content structure, further information in the lectures

Literature
Since the law material is to be partly compiled in the discourse with the studying, a current version of the TKG is to be bring along to the lecture.
Further literature will be announced in the lecture.
Elective literature:
tba

Course: Theoretical Sociology [thSoz]

Coordinators: G. Nollmann, Pfadenhauer, Haupt, Grenz, Eisewicht, Kunz, Albrecht, Enderle, Dukat
Part of the modules: Sociology (p. 156)[WI4SOZ1]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
The student

- gains specific knowledge of a particular research problem.

Content
Students are free to choose any course on specific questions on contemporary research offered by the Institute of Sociology. In class, the specific research question, recent data and current debates on the problem will be presented and discussed.

Workload
The total workload for this course is approximately 60 hours. For further information see German version.

Course: Theory of Business Cycles [25549]

Coordinators: M. Hillebrand
Part of the modules: Macroeconomic Theory (p. 67)[WI4VWL8]

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

Learning Control / Examinations
The assessment consists of 60 min. written exam (according to Section 4 (2), 1 of the examination regulation).
Exams are confined to the following dates: Beginning of the recess period (mid February) and beginning of the summer semester (early April).
Please note: There are no further examination dates for this course.

Conditions
None.

Recommendations
Basic knowledge in micro- and macroeconomics, as conveyed in the courses *Economics I: Microeconomics* [2600012] and *Economics II: Macroeconomics* [2600014], is assumed.
Participants are expected to bring a strong interest in mathematical economics and quantitative model building.

Learning Outcomes
See German version.

Content
Business Cycle research strives to analyze and explain short-run fluctuations in key macroeconomic variables such as production output, income, employment, and prices. The course develops mathematical models which unveil the structural reasons for these fluctuations and the underlying economic mechanisms. Starting with the class of so-called Real Business Cycle (RBC) models, particular emphasis is placed on models of the labor market including models with labor indivisibilities, search-and matching, and home production. Based on the findings obtained, policy implications and the general scope for fiscal and monetary policy to stabilize the economy and foster production output, employment, and price stability are investigated. Numerical simulations based on realistic (calibrated) parameter choices are employed to replicate the empirically observed patterns and to quantify the effects of different policies. Participants are provided with MATLAB scripts allowing them to replicate the simulation results presented in class.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Elective literature:
McCandless,G.(2008): 'The ABCs of RBCs: An Introduction to Dynamic Macroeconomic Models'
Heer, B. & A. Maussner (2009): 'Dynamic General Equilibrium Modeling: Computational Methods and Applications'

Remarks
All classes will be held in English.

Course: Theory of Economic Growth [2520543]

Coordinators: M. Hillebrand
Part of the modules: Macroeconomic Theory (p. 67)[WI4VWL8], Innovation and growth (p. 75)[WI4VWLIWW1]

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

Learning Control / Examinations
The assessment consists of a 60 min. written exam (according to Section 4 (2), 1 of the examination regulation).
Examinations are confined to the following dates: At the beginning of the recess period (mid July) and of the winter semester (early October).
Please note: There are no further examination dates for this course.

Conditions
None.

Recommendations
Basic knowledge in micro- and macroeconomics, as conveyed in the courses *Economics I: Microeconomics* [2600012] and *Economics II: Macroeconomics* [2600014], is assumed.
Participants are expected to bring a strong interest in mathematical economics and quantitative model building.

Learning Outcomes
See German version.

Content
The field of economic growth strives to analyze and explain the long-run evolution of economies. The aim of this course is to develop models which offer a mathematical description of the growth process and its structural determinants. Starting with the fundamental models by Solow, Kaldor, and Pasinetti, the main focus is on so-called overlapping generations (OLG) models. For this class of models, the theory of deterministic dynamical systems offers a rich set of mathematical tools to analyze the long-run behavior of the economy. In particular, conditions under which the growth path converges, diverges, or exhibits irregular (chaotic) fluctuations can be derived. Building on the insights obtained, a second set of questions deals with how economic policy can foster and stabilize the growth process. In this regard, the impact of governmental debt and intergenerational redistribution schemes such as Social Security on economic growth and welfare are investigated.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

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: Operation Methods for Foundation and Marine Construction [6241911]

Coordinators: H. Schneider
Part of the modules: Process Engineering in Construction (p. 135)[WI4INGBGU22]

ECTS Credits	Hours per week	Type	Term	Instruction language
1,5	1	lecture	Winter term	de

Learning Control / Examinations
The assessment consists of an oral exam (20 min.) taking place in the recess period (according to §4 (2), 2 of the examination regulation).

Conditions
None.

Learning Outcomes
Students

- Have specialized knowledge regarding the presented construction methods and construction machinery
- Can evaluate different construction methods and construction machinery regarding the context of use.
- Can determine and combine appropriate construction methods.

Content
Students acquire knowledge regarding design choices and construction methods of temporary pit systems, foundations and harbor facilities:

- Injection,
- Underpinning,
- Pipe-jacking,
- Caisson techniqu
- Fast ice building technique
- Bank protection.

Workload
The total workload for this course is approximately 45.0 hours. For further information see German version.

Media
Lecture slides.

Course: Topics in Econometrics [2520024]

Coordinators: M. Schienle
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar	Summer term	

Learning Control / Examinations
The assessment is done according to §4(2), 3 of the examination regulation.
Students write a seminar paper on an assigned topic (10 to 12 pages), present it in class and discuss results during seminar sessions. These three elements are graded individually. The seminar grade is the weighted average of these individual grades. The weighting depends on the respective seminar.

Conditions
None.

Learning Outcomes

Content

Workload
The total workload for this course is approximately 90 hours.
Lecture 30h
Preparation of lecture 45h
Exam preparation 15h

Course: Topics in Experimental Economics [2520400]

Coordinators: P. Reiss
Part of the modules: Experimental Economics (p. 74)[WI4VWL17]

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

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

Conditions
None.

Recommendations
Basic knowledge of Experimental Economics is assumed. Therefore, it is strongly recommended to attend the course Experimental Economics beforehand.

Learning Outcomes
Students

- are familiar with current research in experimental economics;
- can evaluate the results of an economic experiment and are able to assess its significance in the context of relevant research;
- master advanced methodic issues regarding the experimental method.

Content
The course covers selected topics in experimental economics and deepens the understanding of the experimental method. In particular, topics of current research into experimental and behavioral economics are discussed, along with a treatment of advanced methodic issues.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
Slides, problem sets.

Literature
A selection of published papers is compulsory reading for the course. The course syllabus provides references and is announced at the beginning of the course.

Remarks
The course is offered in summer 2016 for the first time. The course is not offered in every academic year.

Course: Transport Economics [2560230]

Coordinators: G. Liedtke, E. Szimba
Part of the modules: Environmental Economics (p. 66)[WI4VWL5], Network Economics (p. 65)[WI4VWL4], Transport infrastructure policy and regional development (p. 68)[WI4VWL11]

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

Learning Control / Examinations
The assessment is made by a 60 minutes written examination during the semester break (according to §4(2), 1 ERSC). Examination is offered every semester and can be retried at any regular examination date.

Conditions
None.

Learning Outcomes
The course provides students an overview of transport economics. The field deals with the role of transport infrastructure, regulation and pricing in transportation from an economic perspective. The course shall prepare for a career entry in the public sector, a regulation authority or a transport related consultancy. The course also adresses future employees of major construction companies and project corporations for transport infrastructure.
The course gives insights in the complex trade offs to be dealt with in regulatory and infrastructre measures and explains the relevant political considerations. It will be demonstrated, how to estimate the quantitative effects of transport policies using transport models.

Content
The course shall provide an overview of classical welfare economic aspects in referance to planning, asessment, and pricing of transport infrastructure. It will be demonstrated, using new microeconomic models, which impacts regulation and pricing in transport have on the economic actions of individuals and logisticans and which benefits and costs apply. The following topics will be discussed:

- Targets, areas and tools of transport policy,
- Project evaluation from the perspective of the public sector,
- Private sector costing and project evaluation,
- Transport system analysis,
- Macroscopic transport modelling,
- Microeconomic transport demand models, particularly logistics models,
- Case studies.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Media
didactic models in MS-Excel

Literature
Will be announced in the lecture.
(for literature to prepare the lecture - see additional literature)
Elective literature:
Aberle, G: Transportwirtschaft: einzelwirtschaftliche und gesamtwirtschaftliche Grundlagen München; Wien: Oldenbourg, 2003.

Blauwens, G., De Baere, P. and Van der Voorde, E.(2006): Transport Economics.

Frerich, J; Müller, G: Europäische Verkehrspolitik, Landverkehrspolitik
München; Wien: Oldenbourg, 2004.

Dasgupta, A, Pearce, D (1972): Cost-Benefit Analysis, MacMillan, London.

Bossel, H (1994): Modellbildung und Simulation, Vieweg, Braunschweig.

Bundesverkehrswegeplanung (BVWP) (2003), Die gesamtwirtschaftliche Bewertungsmethodik, online unter http://www.bmvbs.de/-,1495.8266/Bundesverkehrswegeplan-2003-Di.htm

BVU, ifo, ITP, and PLANCO (2001): Verkehrsprognose 2015 für die Bundesverkehrswegeplanung, online bei Bundesministerium für Verkehr-, Bau- und Wohnungswesen (http://www.bmvbs.de)
Europäische Kommission (2008): Guide to Cost Benefit Analysis of Investment Projects, online unter http://ec.europa.eu/regional_policy/sou

Ben-Akiva, M., Meerseman, H., and Van de Voorde, E. (2008): Recent developments in transport modelling: Lessons for the freight sector.

Manheim, M. (1979): Fundamentals of Transportation Systems Analysis.

Ortúzar, J. d. D. and Willumsen, L. (1990): Modelling Transport.

Gudehus, T. (2004): “Logistik, Grundlagen, Strategien, Anwendungen”

Course: Tunneling and Blasting [6241910]

Coordinators: S. Haghsheno, L. Scheuble, U. Matz
Part of the modules: Process Engineering in Construction (p. 135)[WI4INGBGU22]

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

Learning Control / Examinations
The assessment consists of an oral exam (ca. 20 min) taking place in the recess period (according to §4 (2), 2 of the examination regulation).

Conditions
None.

Recommendations
None.

Learning Outcomes
See German version.

Content

- construction methods and construction equipment for tunnelling and micro tunnelling works,
- method decision and safeness
- geotechnical and environmental influences
- tube finishing works
- selecting the best construction method
- safety aspects and accident prevention
- Basics in blasting
- Laws and regulations
- Normal and special blasting technologies
- Explosives, fuses and accessories
- Calculation of produced material
- applications
- Safety and accident prevention
- Vibrations and other environmental impacts

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Excercises in Chemical Technology of Water [22602]

Coordinators: H. Horn, Mitarbeiter
Part of the modules: Water Chemistry and Water Technology I (p. 146)[WI4INGCV6]

ECTS Credits	Hours per week	Type	Term	Instruction language
2	1	exercise	Winter term	de

Learning Control / Examinations
See module description.

Conditions
The attendance of the course *Water Technology* is a prerequisite to participate in the exercise.

Learning Outcomes
The student

- deepens the lecture “water technology”,
- has a basic knowledge of water chemistry,
- knows the most important methods for the treatment of different raw waters for drinking and process water purposes.

Content
Tutorials and exercise sheets concerning
1. Chemical-physical basics
2. Lime – carbon dioxide equilibrium
3. Adsorption
4. Ion exchange
5. Oxidation

Workload
The total workload for this course is approximately 60 hours. For further information see German version.

Literature
Elective literature:

- DVGW: Wasseraufbereitung-Grundlagen und Verfahren. In: Lehr- und Handbuch Wasserversorgung Bd.6. Oldenbourg Industrieverlag, 2004.
- Frimmel, F. H.: Wasser und Gewässer. Ein Handbuch. Spektrum Verlag, 1999.
- Sigg,L., Stumm, W.: Aquatische Chemie. Eine Einführung in die Chemie wässriger Lösungen und natürlicher Gewässer. Verlag der Fachvereine Zürich, 1994.
- Stumm, W., Morgan, J. J.: Aquatic Chemistry. Chemical Equilibria and Rates in Natural Waters. 3rd ed. Wiley & Sons, 1996.

Remarks
The course will not be offered any more from winter term 2014/2015 on.

Course: Metal Forming [2150681]

Coordinators: T. Herlan
Part of the modules: Specialization in Production Engineering (p. 101)[WI4INGMB22]

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

Learning Control / Examinations
The assessment consists of an oral exam taking place during the recess period (according to Section 4(2), 2) of the examination regulation).
The examination takes place every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None

Recommendations
None

Learning Outcomes
The students

- are able to reflect the basics, forming processes, tools, Machines and equipment of metal forming in an integrated and systematic way.
- are capable to illustrate the differences between the forming processes, tools, machines and equipment with concrete examples and are qualified to analyze and assess them in terms of their suitability for the particular application.
- are also able to transfer and apply the acquired knowledge to other metal forming problems.

Content
At the beginning of the lecture the basics of metal forming are briefly introduced. The focus of the lecture is on massive forming (forging, extrusion, rolling) and sheet forming (car body forming, deep drawing, stretch drawing). This includes the systematic treatment of the appropriate metal forming Machines and the corresponding tool technology.
Aspects of tribology, as well as basics in material science and aspects of production planning are also discussed briefly. The plastic theory is presented to the extent necessary in order to present the numerical simulation method and the FEM computation of forming processes or tool design. The lecture will be completed by product samples from the forming technology.
The topics are as follows:

- Introduction and basics
- Hot forming
- Metal forming machines
- Tools
- Metallographic fundamentals
- Plastic theory
- Tribology
- Sheet forming
- Extrusion
- Numerical simulation

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).

Literature
Lecture Notes

Remarks
None

Course: Environmental and Ressource Policy [2560548]

Coordinators: R. Walz
Part of the modules: Environmental Economics (p. 66)[WI4VWL5]

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

Learning Control / Examinations

Conditions
None.

Recommendations
It is recommended to already have knowledge in the area of industrial organization and economic policy. This knowledge may be acquired in the courses *Introduction to Industrial Organization* [2520371] and *Economic Policy* [2560280].

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Literature
Elective literature:
Michaelis, P.: Ökonomische Instrumente in der Umweltpolitik. Eine anwendungsorientierte Einführung, Heidelberg
OECD: Environmental Performance Review Germany, Paris

Course: Environmental Aspects of Guided Transport Systems [6234901]

Coordinators: E. Hohnecker
Part of the modules: Track Guided Transport Systems / Engineering (p. 138)[WI4INGBGU27], Project in Public Transportation (p. 136)[WI4INGBGU25], Public Transportation Operations (p. 137)[WI4INGBGU26]

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

Learning Control / Examinations
The assessment will consist of a oral exam (20 min) according to §4 (2), 1 of the examination regulation.
The exam is offered each semester. The re-examination is offered upon prior agreement with the interested participants and not later than the next regular examination date.

Conditions
See module description.

Learning Outcomes
See German version.

Content
Active and passive noise protection, determination of sound emission, environmental aspects

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Remarks
See German version.

Course: Environmental Communication [6224905]

Coordinators: C. Kämpf
Part of the modules: Understanding and Prediction of Disasters 1 (p. 148)[WI4INGINTER7], Understanding and Prediction of Disasters 2 (p. 149)[WI4INGINTER8]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2/1	lecture + exercise	Winter term	

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Recommendations
None.

Learning Outcomes
See German version.

Content
See German version.

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Course: Environmental Economics and Sustainability [2521547]

Coordinators: R. Walz
Part of the modules: Environmental Economics (p. 66)[WI4VWL5]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Winter term	de

Learning Control / Examinations

Conditions
None.

Recommendations
It is recommended to already have knowledge in the area of macro- and microeconomics. This knowledge may be acquired in the courses *Economics I: Microeconomics* [2600012] and *Economics II: Macroeconomics* [2600014].

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Literature
Elective literature:
Hodge, I.: Environmental Economics, Houndsmills
Umweltbundesamt: Nachhaltige Entwicklung in Deutschland, Erich Schmidt Verlag,Berlin

Course: Environmental Law [24140]

Coordinators: G. Sydow
Part of the modules: Environmental Economics (p. 66)[WI4VWL5], Public Business Law (p. 154)[WI4JURA6]

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

Learning Control / Examinations
The assessment consists of an 1h written exam (approx. 60 min) following §4, Abs. 2, 1 of the SPO.
The assessment will be offered in every winter term and can be repeated at every regular examination date.

Conditions
None.

Recommendations
Knowledge of Law, esp. Public Law I or II are recommended.
Parallel to the lectures tutoria are offered in which legal thinking and argumentation is practised. Their attendance is strongly recommended.
During the semester, test exams to each lecture are offered with extensive coaching. During the lecture-free time, a Q-and-A-lecture is offered.Details on the homepage of the ZAR (www.kit.edu/zar)

Learning Outcomes
Environmental law is a field of law that influences management in many regards. Students shall develop a feeling for the many different aspects of environmental law and its instruments. Aside from so-called "classical" approaches such as law-and-order students will learn about other, economic influenced, instruments such as the gathering and the transfer of information or the market for certifiates. On this basis, the course will center around immissions and waste management law. Additionally, water law, protection of soil law and nature protection law will be covered. Students shall be enabled to deal with easy cases in regard to environmental law.

Content
The lecture begins with an introduction into the special problems faced by environmental law. Different instruments, according to common goods theory, will be presented. In the main part of the lecture, immissions law, waste management law, water law, protection of soil law and nature protection law will be analyzed.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
extensive script with cases; content structure, further information in the lectures

Literature
Will be announced in the course.
Elective literature:
Will be announced in the course.

Course: Environmental Impact Assessment [6233804]

Coordinators: R. Roos
Part of the modules: Highway Engineering (p. 129)[WI4INGBGU2]

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

Learning Control / Examinations
See module description

Conditions
See corresponding module information

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 45.0 hours. For further information see German version.

Course: Management and Strategy [2577900]

Coordinators: H. Lindstädt
Part of the modules: Strategic Corporate Management and Organization (p. 33)[WI4BWLUO1]

ECTS Credits	Hours per week	Type	Term	Instruction language
3.5	2/0	lecture	Summer term	de

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

Conditions
None.

Learning Outcomes
After passing this course students are able to

- prepare strategic decisions along the ideal-typical strategy process in practice ("strategic analysis").
- assess strategic options.
- explain the portfolio management (Parental advantage and best owner of business entities).
- discuss price and capacity decisions in oligopolies and explain them in examples.

Content
The participants learn about central concepts of strategic management along the ideal-typical strategy process: internal and external strategic analysis, concept and sources of competitive advantages, their importance when establishing competitive and corporate strategies as well as strategy assessment and implementation. This aims in particular to provide a summary of the basic concepts and models of strategic management, i.e. to provide in particular an action-oriented integration. Thereby a focus is on imparting knowledge about how price developments in oligopolistic markets can be understood, modeled and forecasted based on game theory.

Workload
The total workload for this course is approximately 105.0 hours. For further information see German version.

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.

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

Course: Urban Water Management [6220902]

Coordinators: S. Fuchs, P. Klingel, U. Mohrlok
Part of the modules: Water Supply and Sanitation (p. 131)[WI4INGBGU13]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	4	lecture + exercise	Winter term	de

Learning Control / Examinations
The assessment consists of an oral exam (30 min) taking place in the recess period (according to §4 (2), 2 of the examination regulation).

Conditions
None.

Recommendations
Attendance to the lectures *Siedlungswasserwirtschaft* [0170603] and *Verfahrenstechnische Anlagen der Regenwasserbehandlung* [6223801] is recommended

Learning Outcomes
The students will gain knowledge regarding an integrated water management with focus on urban areas.
Basic knowledge in water-related substances transport and fate on sealed areas, in surface water, water distribution and sewer systems and groundwater bodies will be examined

Content

- Amount and quality of different runoff components
- Indicators of pollution
- Tools for urban water management (water distribution, urban drainage, surface and ground waters, characteristics of urban surface waters)

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

Media
Lecture notes

Course: Copyright [24121]

Coordinators: T. Dreier
Part of the modules: Governance, Risk & Compliance (p. 155)[WI4JURGRC], Intellectual Property Law (p. 152)[WI4JURA4]

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

Learning Control / Examinations
The assessment consists of a written exam according to section 4 subsection 2 no. 1 study and examination regulations.

Conditions
None.

Learning Outcomes
The students have competent knowledge in the area of national, European and international copyright law that builds upon, and goes beyond the knowledge the students have already acquired in the general lecture of “Industrial and intellectual property law”. Students understand how the legal rules depend upon, and interact with, the economic background, legislative policy and information and communication technologies. They are able to apply these legal rules in practical cases.

Content
The course deals with the subject matter of copyright, the rights of authors, licensing, limitations and exceptions to copyright, term of protection, neighbouring rights, enforcement and collective administration of rights. The course does not merely focus on German copyright law, but likewise puts European and international copyright law into perspective. Students shall understand how the legal rules depend upon, and interact with, the economic background, legislative policy and information and communication technologies. Students shall learn about the rules of national, European and international copyright law and to apply these legal rules in practical cases.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
slides

Literature
Schulze, Gernot Meine Rechte als Urheber Verlag C.H.Beck, current edition
Elective literature:
Additional literature tba in class.

Remarks
It is possible that this course will be taught in the summer instead of the winter semester.

Course: Valuation [2530212]

Coordinators: M. Ruckes
Part of the modules: Cross-functional Management Accounting (p. 36)[WI4BWLIBU2], Finance 2 (p. 27)[WI4BWLFBV2], Finance 3 (p. 28)[WI4BWLFBV11], Finance 1 (p. 26)[WI4BWLFBV1]

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

Learning Control / Examinations

Conditions
None.

Learning Outcomes
Students

- are in a position to evaluate corporate investment projects from a financial point of view,
- are able to value companies,
- are in a position to evaluate the financial consequences of mergers and acquisitions,
- are able to measure the value of flexibility.

Content
Firms prosper when they create value for their shareholders and stakeholders. This is achieved by investing in projects that yield higher returns than their according cost of capital. Students are told the basic tools for firm and project valuation as well as ways to implement these tools in order to enhance a firm's value and improve its investment decisions. Among other things, the course will deal with the valuation of firms and individual projects using discounted cash flow and relative valuation approaches and the valuation of flexibility deploying real options.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Elective literature:
Titman/Martin (2015): Valuation – The Art and Science of Corporate Investment Decisions, 3rd edition, Prentice Hall.

Course: Vehicle Ride Comfort & Acoustics I [2114856]

Coordinators: F. Gauterin
Part of the modules: Handling Characteristics of Motor Vehicles (p. 94)[WI4INGMB6]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	en

Learning Control / Examinations
The assessment consists of an oral exam (30 - 40 min) taking place in the recess period (according to §4 (2), 2 of the examination regulation).

Conditions
Can not be combined with lecture Fahrzeugkomfort und -akustik I.

Recommendations
None.

Learning Outcomes
The students know what noises and vibrations mean, how they are generated, and how they are perceived by human beings. They have knowledge about the requirements given by users and the public. They know which components of the vehicle are participating in which way on noise and vibration phenomenon and how they could be improved. They are ready to apply different tools and methods to analyze relations and to judge them. They are able to develop the chasis regarding driving comfort and acoustic under consideration of goal conflicts.

Content
1. Perception of noise and vibrations

3. Fundamentals of acoustics and vibrations

3. Tools and methods for measurement, computing, simulation and analysis of noise and vibrations

4. The relevance of tire and chasis for the acoustic and mechanical driving comfort:
phenomena, influencing parameters, types of construction, optimization of components and systems, conflict of goals, methods of development

An excursion will give insights in the development practice of a car manufacturer or a system supplier.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
1. Michael Möser, Technische Akustik, Springer, Berlin, 2005

2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

3. Manfred Mitschke, Dynamik der Kraftfahrzeuge, Band B: Schwingungen, Springer, Berlin, 1997

The script will be supplied in the lectures

Course: Vehicle Ride Comfort & Acoustics II [2114857]

Coordinators: F. Gauterin
Part of the modules: Handling Characteristics of Motor Vehicles (p. 94)[WI4INGMB6]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	en

Learning Control / Examinations
The assessment consists of an oral exam (30 - 40 min) taking place in the recess period (according to §4 (2), 2 of the examination regulation).

Conditions
Can not be combined with lecture Fahrzeugkomfort und -akustik II .

Recommendations
None.

Learning Outcomes
The students have knowledge about the noise and vibration properties of the chassis components and the drive train. They know what kind of noise and vibration phenomena do exist, what are the generation mechanisms behind, which components of the vehicle participate in which way and how could they be improved. They have knowledge in the subject area of noise emission of automobiles: Noise impact, legal requirements, sources and influencing parameters, component and system optimization, target conflicts and development methods. They are ready to analyze, to judge and to optimize the vehicle with its single components regarding acoustic and vibration phenomena. They are also able to contribute competently to the development of a vehicle regarding the noise emission.

Content
1. Summary of the fundamentals of acoustics and vibrations

2. The relevance of road surface, wheel imperfections, springs, dampers, brakes, bearings and bushings, suspensions, engines and drive train for the acoustic and mechanical driving comfort:
- phenomena
- influencing parameters
- types of construction
- optimization of components and systems
- conflicts of goals
- methods of development

3. Noise emission of motor vehicles
- noise stress
- sound sources and influencing parameters
- legal restraints
- optimization of components and systems
- conflict of goals
- methods of development

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
The script will be supplied in the lectures.

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

Coordinators: R. Kneuper
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

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

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

Conditions
None.

Learning Outcomes
Students master the basics of capability maturity models, oversee the whole process in project management and development processes according to CMMI and SPICE. They know how to use capability maturity models for quality assurance.

Content
Capability maturity models like CMMI and SPICE are an important tool for assessing and improving software development. A significantly increasing number of companies use these models in their own approach to improve their development and to demonstrate a certain minimum quality and effective external presentation. This is the case in Germany, especially in the automotive industry, but also many other industries.

Preliminary Structure of the lecture:

1. Introduction and Overview, motivation
2. Project management according to CMMI
3. Development processes according to CMMI
4. Process management and supporting processes according toCMMI
5. Differences between SPICE and CMMI
6. Introduction of capability maturity models
7. Assessments and Appraisals
8. Costs and benefits of capability maturity models

Workload
Workload: 120h overall,
Lecture 30h
Review and preparation of lectures 60h
Exam preparation 29h
Exam 1h

Media
Slides, access to internet resources.

Literature
Literature is given in each lecture individually.

Course: Combustion Engines I [2133113]

Coordinators: H. Kubach, T. Koch
Part of the modules: Combustion Engines I (p. 97)[WI4INGMB34]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Winter term	de

Learning Control / Examinations
See module description.

Conditions
None.

Recommendations
None.

Learning Outcomes
The student can name and explain the working princile of combustion engines. He is able to analyse and evaluate the combustion process. He is able to evaluate influences of gas exchange, mixture formation, fuels and exhaust gas aftertreatment on the combustion performance. He can solve basic research problems in the field of engine development.

Content
Introduction, History, Concepts
Working Principle and Termodynamics
Characteristic Parameters
Air Path
Fuel Path
Energy Conversion
Fuels
Emissions
Exhaust Gas Aftertreatment

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Course: Combustion Engines II [2134151]

Coordinators: H. Kubach, T. Koch
Part of the modules: Combustion Engines II (p. 98)[WI4INGMB35]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Summer term	de

Learning Control / Examinations
oral examination, duration: 25 minutes, no auxiliary means

Conditions
None.

Recommendations
Fundamentals of Combustion Engines I helpful

Learning Outcomes
The students deepen and complement their knowledgement from the lecture combustion engines A. they can name and explain construction elements, development tools and latest development trends. They are be able to analyse and evaluate powertrain concepts which are subject of the lecture.

Content
Emissions
Fuels
Drive Train Dynamics
Engine Parts
Boosting
Alternative Powertrain Concepts

Special Engine Concepts

Power Transmission

Workload
The total workload for this course is approximately 150 hours. For further information see German version.

Course: Process Engineering [6241704]

Coordinators: H. Schneider, H. Schlick
Part of the modules: Process Engineering in Construction (p. 135)[WI4INGBGU22]

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

Learning Control / Examinations
The assessement consists of a written exam (90 minutes) (following §4(2), 1 of the examination regulation).

Conditions
The course [6241704] is compulsory and must be examined.

Recommendations
It is recommended to attend the module Fundamentals of Construction [WI3INGBGU3] of the B.Sc. studies.

Learning Outcomes
Students understand the important fields of mechanical process engineering in construction. They can evaluate construction methods and aggregate production methods based on the context of use and they can analyze the use of important construction equipment, construction methods and aggregate production methods.

Content
The lecture comprises:

- Overview of construction equipment (Baugeräteliste BGL)
- Equipment characteristics and variants
- Operational characteristics of equipment
- Mode of operation of equipment and of systems of equipment
- Overview of mode of production in earth moving, foundation construction and marine construction.
- Design and mode of operation of aggregate production.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Lecture slides.

Remarks
This course was formerly named “Construction Equipment and Mechanical Process Engineering”.
The credits have been changed from 4,5 to 3.

Course: Disassembly Process Engineering [6241828]

Coordinators: S. Gentes
Part of the modules: Process Engineering in Construction (p. 135)[WI4INGBGU22]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	1/1	lecture + exercise	Summer term	

Learning Control / Examinations
The assessment consists of an oral exam (ca. 20 min) taking place in the recess period (according to §4 (2), 2 of the examination regulation).

Conditions
None.

Recommendations
None.

Learning Outcomes
See German version.

Content
See German version.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
See German version.

Course: Process Technologies in Storm Water Treatment [6223801]

Coordinators: S. Fuchs, E. Hoffmann
Part of the modules: Water Supply and Sanitation (p. 131)[WI4INGBGU13]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture + exercise	Summer term	de

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Recommendations
Attendance to the course *Siedlungswasserwirtschaft* [0170603] is recommended.

Learning Outcomes
The students will gain knowledge regarding planning, operation and dimensioning of different plants for storm water treatment. Design and construction requirements and limitations will be examined having a closer look at the natural and anthropogenic substances cycles

Content

- Problem-oriented and location adapted treatment concepts
- Dimensioning approaches for plants in storm water treatment

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Lecture notes

Course: Process Technologies in Water Supply and Wastewater Disposal [6223803]

Coordinators: E. Hoffmann
Part of the modules: Water Supply and Sanitation (p. 131)[WI4INGBGU13]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture + exercise	Summer term	de

Learning Control / Examinations
Non exam assessment (following §4(2), 3 of the examination regulation).

Conditions
None.

Recommendations
Recommendation: course „Appropriate Technologies“ (6223902/3)

Learning Outcomes
The students will gain knowledge regarding planning, operation and dimensioning of different plants for water treatment. Design, construction requirements and limitations will be examined.

Content

- Problem-orientated and location adapted treatment concepts
- Dimensioning approaches for plants in water treatment

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
Lecture notes.

Remarks
The lecture is part of the module „Water Supply and Sanitation (Wasserver- und entsorgung)“ and is offered together with the lecture Process Technologies in Storm Water Treatment

Course: Behavioral Approaches in Marketing [2572167]

Coordinators: B. Neibecker
Part of the modules: Marketing Management (p. 51)[WI4BWLMAR5], Strategy, Communication, and Data Analysis (p. 54)[WI4BWLMAR7]

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

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

Conditions
See module description.

Learning Outcomes
Students have learned the following outcomes and competences:

- To specify the key terms in marketing and communication management
- To identify and define theoretical constructs in marketing communication, based on behavioral theory
- To indentify the main research trends
- To analyze and interpret high level academic articles
- To learn interactive skills to work in teams and to follow a goal-oriented approach
- To gain understanding of methodological research to develop concrete plans for marketing decision-making

Content
This course gives an introduction to consumer behavior and the influence of cognitive and emotional information processing on consumer decision making. The contribution of advertising response models is considered and faced with social and environmental aspects (e.g. cross-cultural influences) on consumer behavior, mass communication and internet advertising. In addition, a scientific case study on the effectiveness of TV-commercials is discussed. Central issues of the course:
Case Studies in brand management and advertising response.
Psychological factors (research design and test marketing / arousal / effectiveness of TV-commercials as case studies).
Emotions in marketing.
Information processing and retention in memory (schema theory / visual information processing/grounded theory).
Complex advertising response models (attitude towads the ad / attitude towards the brand / persuasion / context effects in learning / decision making / Means-end-theory and strategic advertising).
Social processes (culture / subculture / cross cultural influence / product design).
Neuromarketing.

Workload
The total workload for this course is approximately 140.0 hours. For further information see German version.

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

Course: Laws concerning Traffic and Roads [6233803]

Coordinators: D. Hönig
Part of the modules: Safety, Computing and Law in Highway Engineering (p. 130)[WI4INGBGU9]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

Learning Control / Examinations
See module description.

Conditions
See corresponding module information.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Traffic Management and Transport Telematics [6232802]

Coordinators: P. Vortisch
Part of the modules: Transportation Modelling and Traffic Management (p. 134)[WI4INGBGU16]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	1/1	lecture + exercise	Summer term	de

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

Conditions
See module description.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Transportation [6200405]

Coordinators: P. Vortisch
Part of the modules: Fundamentals of Transportation (p. 133)[WI4INGBGU15]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture + exercise	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Course: Failure of Structural Materials: Fatigue and Creep [2181715]

Coordinators: O. Kraft, P. Gumbsch, P. Gruber
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

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

Learning Control / Examinations
The assessment consists of an oral examination (30 min) according to Section 4(2), 2 of the examination regulation.

Conditions
None.

Recommendations
None.

Learning Outcomes
The student

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

Content
1 Fatigue
1.1 Introduction
1.2 Statistical Aspects
1.3 Lifetime
1.4 Fatigue Mechanisms
1.5 Material Selection
1.6 Thermomechanical Loading
1.7 Notches and Shape Optimization
1.8 Case Study: ICE-Desaster

2 Creep
2.1 Introduction
2.2 High Temperature Plasticity
2.3 Phänomenological DEsciption of Creep
2.4 Creep Mechanisms
2.5 Alloying Effects

Workload
regular attendance: 22,5 hours
self-study: 97,5 hours

Literature

- Engineering Materials, M. Ashby and D.R. Jones (2nd Edition, Butterworth-Heinemann, Oxford, 1998); worth reading, relatively simple but comprehensive
- Mechanical Behavior of Materials, Thomas H. Courtney (2nd Edition, McGraw Hill, Singapur); classic on the mechanical behavior of materials, extensive and good
- Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relatively simple but yet comprehensive overview of metallic materials
- Fatigue of Materials, Subra Suresh (2nd Edition, Cambridge University Press); standard work on fatigue, all classes of materials, extensive, for beginners and advanced student

Course: Failure of structural materials: deformation and fracture [2181711]

Coordinators: P. Gumbsch, O. Kraft, D. Weygand
Part of the modules: Specific Topics in Materials Science (p. 113)[WI4INGMB33]

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

Learning Control / Examinations
oral exam 30 minutes
no tools or reference materials

Conditions
compulsory preconditions: none

Recommendations
preliminary knowlegde in mathematics, mechanics and materials science

Learning Outcomes
The student

- has the basic understanding of mechanical processes to explain the relationship between externally applied load and materials strength.
- can explain the foundation of linear elastic fracture mechanics and is able to determine if this concept can be applied to a failure by fracture.
- can decribe the main empirical materials models for deformation and fracture and can apply them.
- has the physical understanding to describe and explain phenomena of failure.

Content

1. Introduction
2. linear elasticity
3. classification of stresses
4. Failure due to plasticity
    - tensile test
    - dislocations
    - hardening mechanisms
    - guidelines for dimensioning
5. composite materials
6. fracture mechanics
    - hypotheses for failure
    - linear elasic fracture mechanics
    - crack resitance
    - experimental measurement of fracture toughness
    - defect measurement
    - crack propagation
    - application of fracture mechanics
    - atomistics of fracture

Workload
regular attendance: 22,5 hours
self-study: 97,5 hours

Literature

- Engineering Materials, M. Ashby and D.R. Jones (2nd Edition, Butterworth-Heinemann, Oxford, 1998); worth reading, relatively simple but comprehensive
- Mechanical Behavior of Materials, Thomas H. Courtney (2nd Edition, McGraw Hill, Singapur); classic on the mechanical behavior of materials, extensive and good
- Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relatively simple but yet comprehensive overview of metallic materials

Course: Civil Law for Advanced [24650]

Coordinators: Z. (ZAR)
Part of the modules: Private Business Law (p. 153)[WI4JURA5]

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

Learning Control / Examinations
The assessment consists of a written exam following § 4, Abs. 2, 1 SP.

Conditions
None.

Recommendations
Knowledge in Civil Law is presumed as it is taught in the courses BGB for beginners [24012], *BGB for advanced learners* [24504] and *Commercial and Corporate Law* [24011]

Learning Outcomes
The students will have extensive knowledge in german corporate law, trade law and civil law especially in contract law, exceeding the knowledge the students have obtained in the courses *Civil Law for Beginners* [24012], *Advanced Civil Law* [24504], and *Commercial and Corporate Law* [24011/24509],. At the end students are able to think through complex legal and economic questions.

Content
The course will focus on corporate law, trade law and civil law, especially contract law. We will discuss legal problems on the basis of selected examples in a application orientated way.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Tba at the beginning of the course.

Course: Specialization in Principles of Process Engineering referring to food [22214]

Coordinators: V. Gaukel
Part of the modules: Principles of Food Process Engineering (p. 144)[WI4INGCV3]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2/0	lecture	Summer term	de

Learning Control / Examinations
See module description.

Conditions
None.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Remarks
This course was formerly named “Principles of Process Engineering referring to Food II”.

Course: Seminar: Governance, Risk & Compliance [2400041]

Coordinators: T. Dreier, N.N.
Part of the modules: Governance, Risk & Compliance (p. 155)[WI4JURGRC]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	seminar	Summer term	de

Learning Control / Examinations

Conditions
The course *Corporate Compliance* [2400087] is required.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
slides

Literature
Tba at the beginning of the course.

Course: Law of Contracts [24671]

Coordinators: Z. (ZAR)
Part of the modules: Private Business Law (p. 153)[WI4JURA5], Governance, Risk & Compliance (p. 155)[WI4JURGRC]

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

Learning Control / Examinations
The assessment consists of a written exam following § 4, Abs. 2, 1 SPO.

Conditions
None.

Learning Outcomes
The course will provide an overview of the forming of an contract. The purpose is to translate legal and economic aspects in a contract to secure the volitional position. The course will also consider international questions.

Content
The purpose of the course is to provide students with an understanding of the legal basics of forming a business contract. By means of special examples an overview of typical corporate contracts will be given. The course discusses the Limited (GmbH), ordinary partnership (OHG), limited partnership (KG), European Economic Interest Grouping (EWIV), club (Verein) and the pubilc limited company (Aktiengesellschaft). In addition it will also focus on international relations.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Tba at the beginning of the course.

Course: Computer Contract Law [VGE]

Coordinators: M. Bartsch
Part of the modules: Intellectual Property Law (p. 152)[WI4JURA4]

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

Learning Control / Examinations
The assessment consists of a written exam following §4, Abs. 2, 1 of the SPO.

Conditions
None.

Learning Outcomes
It is the aim of this course to provide students with knowledge in the area of contract formation and formulation in practice that builds upon the knowledge the students have already acquired concerning the legal protection of computer programs. Students shall understand how the legal rules depend upon, and interact with, the economic background and the technical features of the subject. The contract drafts shall be prepared by the students and will be corporately completed during the lecture. It is the aim of the course that students will be able to formulate contracts by themselves.

Content
The course deals with contracts from the following areas:

- Contracts of programming, licencing and maintaining software
- Contracts in the field of IT employment law
- IT projects and IT Outsourcing
- Internet Contracts

From these areas single contracts will be chosen and discussed (e.g. software maintenance, employment contract with a software engineer). Concerning the respective contract the technical features, the economic background and the subsumption in the national law of obligation (BGB-Schuldrecht) will be discussed. As a result different contractual clauses will be developed by the students. Afterwards typical contracts and conditions will be analysed with regard to their legitimacy as standard business terms (AGB). It is the aim to show the effects of the german law of standard business terms (AGB-Recht) and to point out that contracts are a means of drafting business concepts and market appearance.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Media
transparancies

Literature

- Langenfeld, Gerrit Vertragsgestaltung Verlag C.H.Beck, III. Aufl. 2004
- Heussen, Benno Handbuch Vertragsverhandlung und Vertragsmanagement Verlag C.H.Beck, II. Aufl. 2002
- Schneider, Jochen Handbuch des EDV-Rechts Verlag Dr. Otto Schmidt KG, III. Aufl. 2002

Elective literature:
tba in the transparencies

Course: Gear Cutting Technology [2149655]

Coordinators: M. Klaiber
Part of the modules: Specialization in Production Engineering (p. 101)[WI4INGMB22]

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

Learning Control / Examinations
The assessment consists of an oral exam taking place during the recess period (according to Section 4(2), 2) of the examination regulation).
The examination takes place every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None

Recommendations
None

Learning Outcomes
The students . . .

- can describe the basic terms of gearings and are able to explain the imparted basics of the gearwheel and gearing theory.
- are able to specify the different manufacturing processes and machine technologies for producing gearings. Furthermore they are able to explain the functional principles and the dis-/advantages of these manufacturing processes.
- can apply the basics of the gearing theory and manufacturing processes on new problems.
- are able to read and interpret measuring records for gearings.
- are able to make an appropriate selection of a process based on a given application
- can describe the entire process chain for the production of toothed components and their respective influence on the resulting workpiece properties.

Content
Based on the gearing theory, manufacturing processes and machine technologies for producing gearings, the needs of modern gear manufacturing will be discussed in the lecture. For this purpose, various processes for various gear types are taught which represent the state of the art in practice today. A classification in soft and hard machining and furthermore in cutting and non-cutting technologies will be made. For comprehensive understanding the processes, machine technologies, tools and applications of the manufacturing of gearings will be introduced and the current developments presented. For assessment and classification of the applications and the performance of the technologies, the methods of mass production and manufacturing defects will be discussed. Sample parts, reports from current developments in the field of research and an excursion to a gear manufacturing company round out the lecture.
The following topics will be covered:

- Sample applications
- Basics of gearing geometry
- Need of gearboxes
- Soft machining processes
- Hardening processes
- Hard machining processes
- Bevel gear production
- Measurement and testing
- Manufacturing of gearbox components
- Special gearings

Workload
regular attendance: 21 hours
self-study: 99 hours

Media
Lecture slides will be provided in ilias (https://ilias.studium.kit.edu/).

Literature
Lecture Slides

Remarks
None

Course: Virtual Engineering I [2121352]

Coordinators: J. Ovtcharova
Part of the modules: Virtual Engineering A (p. 109)[WI4INGMB29]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	2/3	lecture + exercise	Winter term	de

Learning Control / Examinations
The assessment is carried out as a general oral exam (30 min.) (according to Section 4(2), 2 of the examination regulation) of the single course of this module. The examination is offered every semester. Re-examinations are offered at every ordinary examination date. The overall grade of the module is the grade of the oral examination.

Conditions
The course Virtual Engineering I [2123352] is compulsory and must be examined in the module Virtual Engineering A [WI4INGMB29].

Recommendations
None.

Learning Outcomes
The students can:

- rename and explain the basic methods of virtual engineering and the typical problems in product development.
- associate the methods and problems of the corresponding phases of the product life cycle and derive the necessary interfaces.
- select the appropriate IT systems for given problems and evaluate their suitability for the support of management's approach PLM.
- apply CAD/CAx/PLM-Systems using simple exercises.

Content
The lecture presents the informational interrelationship required for understanding the virtual product development process. For this purpose, an emphasis and focus will be placed on IT-systems used in the industrial sector as support for the process chain of virtual engineering:

- Product Lifecycle Management refers to the entire lifecycle of the product, beginning with the concept phase up through disassembling and recycling.
- CAx-systems for the virtual product development allow the modeling of a digital product in regards to design, construction, manufacturing and maintenance.
- Validation Systems allow the checking of the product in regard to static, dynamics, safety and build ability.

The goal of the lecture is to clarify the relationship between construction and validation operations through the usage of virtual prototypes and VR/AR/MR visualisation techniques in connection with PDM/PLM-systems. This will be achieved through an introduction to each particular system along with praxis-oriented exercises.

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

Literature
Lecture slides

Course: Virtual Engineering II [2122378]

Coordinators: J. Ovtcharova
Part of the modules: Virtual Engineering B (p. 110)[WI4INGMB30]

ECTS Credits	Hours per week	Type	Term	Instruction language
4	2/1	lecture + exercise	Summer term	de

Learning Control / Examinations
The assessment is carried out as a general oral exam (20 min.) (according to Section 4(2), 2 of the examination regulation) of the single course of this module. The examination is offered every semester. Re-examinations are offered at every ordinary examination date. The overall grade of the module is the grade of the oral examination.

Conditions
The course Virtual Engineering II [2122378] is compulsory and must be examined in the module Virtual Engineering B [WI4INGMB30].

Recommendations
Knowledge of CAx is assumed. Therefore it is recommended to attend the course Virtual Engineering I [2121352] beforehand.

Learning Outcomes
The students will be able to:

- describe virtual reality, how the stereoscopic effect occurs and compare the technologies to simulate this effect.
- describe how to model a scene in VR, store the VR graph on a computer and explain the inner workings of the VR pipeline for visualizing the scene.
- name various systems for interacting with the VR scene and assess the advantages and disadvantages of various manipulation and tracking devices.
- compare validation tests that can be carried through in the product development process with the aid of a virtual mock-up (VMU) and describe the difference between a VMU, a physical mock-up (PMU) and a virtual prototype (VP).
- point out the vision of an integrated virtual product development and which challenges need to be resolved towards that vision.

Content
The lecture presents the informational interrelationship required for understanding the virtual product development process. For this purpose, an emphasis and focus will be placed on IT-systems used in the industrial sector as support for the process chain of virtual engineering:

- The corresponding models can be visualized in Virtual Reality Systems, from single parts up through a complete assembly.
- Virtual Prototypes combine CAD-data as well as information about the remaining characteristics of the components and assembly groups for immersive visualisation, functionality tests and functional validations in the VR/AR/MR environment.
- Integrated Virtual Product Development explains exemplified the product development process from the point of view of Virtual Engineering.

The goal of the lecture is to clarify the relationship between construction and validation operations through the usage of virtual prototypes and VR/AR/MR visualisation techniques in connection with PDM/PLM-systems. This will be achieved through an introduction to each particular IT-system along with praxis-oriented exercises.

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Literature
Lecture slides

Course: Virtual Reality Laboratory [2123375]

Coordinators: J. Ovtcharova
Part of the modules: Virtual Engineering B (p. 110)[WI4INGMB30], Virtual Engineering A (p. 109)[WI4INGMB29]

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

Learning Control / Examinations
The assessment is carried out as assessment of another type (according to Section 4(2), 3 of the examination regulation) and is made up of a Presentation of the project work (40%), the individual project participation (30%), a written test (20%) and soft skills (10%).

Conditions
Limited number of participants, for selection procedure and registration see course homepage.

Recommendations
None.

Learning Outcomes
The students are able to operate and use hardware and software for Virtual Reality applications in order to:

- design solutions for complex tasks in a team.
- solve subtasks within a specific work package in small groups, keeping the interfaces to other work packages in mind and
- merge this solution in the final product.

Content
The Virtual Reality lab course consists of following three overlapping parts:

- Basics: Introduction in Virtual Reality (hardware, software, applications)
- Tool Kit: Exercises in the task specific software systems
- Application: autonomous project work in the area of Virtual Reality in small groups

Soft Skills: Methodical approach to practical engineering problems, team and interdisciplinary work, time management.

Workload
Regular attendance: 31,5 hours, self-study: 88 hours

Media
Stereoscopic projection in MR and VR at the Lifecycle Engineering Solutions Center (LESC), 15 computers, beamer

Literature
Presentations, Exercise documents, Tutorials, Books for individual work

Course: Heat Economy [2581001]

Coordinators: W. Fichtner
Part of the modules: Energy Economics and Technology (p. 50)[WI4BWLIIP5]

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

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

Conditions
None.

Learning Outcomes
The student gains detailed knowledge about heat generating technologies and their areas of application, in particular in the area of combined heat and power. The student is able to deal with technical and economic questions in this field.

Content
1. Introduction: Heat economy
2. CHP technologies (incl. calculation of profitability)
3. Heat systems (incl. calculation of profitability)
4. Distribution of heat
5. Demand for space heating and thermal insulation measures
6. Heat storage
7. Legal framework conditions
8. Laboratory experiment: compression heat pump

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

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

Course: Elective „Educational development for student teachers“ [SQ PEW1]

Coordinators: Personalentwicklung
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
2 / 3	k.A.	other	Winter / Summer Term	de

Learning Control / Examinations
Success is controlled according to §4(2), 3 SPO in the course of completion of different units of the tutorial program. These units consist of successful processing of online-units on Ilias platform, participating on the tutoring workshop and in at least one practice consulting, authoring a concluding work of reflection about own work of tutoring as well as writing a feedback on the work of reflection of another tutor. Participants will receive guidelines prior to writing the work of reflection and the feedback.
If the participant works for two semesters as a tutor, 3 ECTS-points are credited. If the participant works for one semester as a tutor, only 2 ECTS-points are credited.

Conditions
Activity as tutor during the semester participating in the tutorial program is obligatory.

Recommendations
None.

Learning Outcomes

- Tutors are able to create their specific teaching situation based on their knowledge on didactical methods and learning processes.
- Tutors are able to analyze and control communications in teaching according to established models of communication (Watzlawick, Schulz von Thun).
- Tutors are able to explain and apply different instruments to purposefully intervene in learning and teaching situations in single or group settings.
- Tutors are able to name the rights and duties of their role as tutors and act according to them.
- Tutors are able to estimate their strengths and weaknesses as a teacher and are able to name strategies of further development.

Content
The tutoring program deals with theoretical and practical aspects of teaching behavior within the scope of a self-learning period by means of online-learning issues as well as in an classroom event lasting several days. The following topics are introduced and a thematical overview is given of:
- tutoring role and expectations, partly contrary, connected with it
- giving and receiving feedback
- basics of conversation
- aspects of learning process
- basics of planning a lecture/class
- evaluation/assessment and psychological sources of error connected with it
- intercultural communication during lecture/class
- moderation of a colloquium and moderation in teaching
- techniques of presentation with video feedback
- guiding teams and integrating group processes in the setting of teaching
- handling of difficult teaching-learning-situations
- guiding and evaluating scientific writing

Students get to know and practice the method of collegial coaching. They sit in on each other's lectures/classes and give each other feedback with the aid of a guideline. Tutors reflect in written form their own development as a teacher during the semester. Moreover they give each other a written feedback on this work of reflection.

Workload
Work amount is according to the kind of lecture/class. It is individually split in study in classroom and self-study. Contents of the program can be:

- Working on online units in preparation of an in-class event
- basic/advanced workshop
- collegial coaching
- collegial sitting in on lectures/classes
- written work of reflection and peer-review

Remarks

Please note that a maximum of 3 ECTS- points in the seminar module is distributed over Bachelor and Master.
The language of all events of the tutoring program is German.
Further information on the tutoring program is found on the homepage of Personnel Development service unit www.pew.kit.edu/387.php.

Course: Laboratory Work "Water" [22664]

Coordinators: H. Horn, G. Abbt-Braun
Part of the modules: Water Chemistry and Water Technology I (p. 146)[WI4INGCV6]

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

Learning Control / Examinations
The assessement consists of course-related experiments (according to §4(2), 3 of the examination regulation) and an final oral exam (according to §4(2), 2 of the examination regulation).

The grade of this course is made up of 50 % each from the two parts of the assessment.

The successful completion of the *Laboratory Work "Water"* [22664] ist prerequisited for admission to the module examination.

Conditions
None.

Learning Outcomes
The student

- has knowledge of types of the water constituents,
- has the basic knowledge of the analysis of water constituents,
- knows and understands the most important methods for the treatment of different types of raw water.

Content
Technical and water chemical experiments:
Lime solution experiment,
Flocculation,
Adsorption,
Oxidation,
Atom absorption spectrometry,
Ion chromatography,
HPLC and
Sum parameters.

Workload
The total workload for this course is approximately 120 hours. For further information see German version.

Literature
Elective literature:

- Frimmel, F. H.: Wasser und Gewässer. Ein Handbuch. Spektrum Verlag, 1999.
- Frimmel, F. H., Abbt-Braun, G.: Wasser-technologisches und wasserchemisches Praktikum. Band 44. Schriftenreihe des Lehrstuhls für Wasserchemie und der DVGW-Forschungsstelle am Engler-Bunte-Institut der Universität Karlsruhe (TH), 2006.
- Sigg, L., Stumm, W.: Aquatische Chemie. Eine Einführung in die Chemie wässriger Lösungen und natürlicher Gewässer. Verlag der Fachvereine Zürich, 1994.

Remarks
The successful completion of the *Laboratory Work "Water"* [22664] is prerequisited for admission to the module examination.

Course: Water Resources Management and Engineering Hydrology [6200617]

Coordinators: J. Ihringer
Part of the modules: Understanding and Prediction of Disasters 1 (p. 148)[WI4INGINTER7], Understanding and Prediction of Disasters 2 (p. 149)[WI4INGINTER8]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	1/1	lecture + exercise	Summer term	

Learning Control / Examinations
See German version.

Conditions
None.

Recommendations
None.

Learning Outcomes
See German version.

Content
See German version.

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Web Science [2511312]

Coordinators: Y. Sure-Vetter
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	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 or an oral exam (20 min) following §4, Abs. 2, 2 of the examination regulation.
The exam takes place every semester and can be repeated at every regular examination date.

Conditions
None.

Learning Outcomes
The students

- are familiar with current research topics in the field of Web Science and learns in particular about the topics small-world-problem, network theory, social network analysis, bibliometrics as well as link analysis and search.
- are able to apply interdisciplinary thinking.
- are able to apply technological approaches to social science problems.

Content

Workload
The total workload for this course is approximately 150 hours. For further information see German version

Media
Lecture slides.

Literature

- Networks, Crowds, and Markets: Reasoning About a Highly Connected World, by David Easley and Jon Kleinberg, 2010 (free online book: http://www.cs.cornell.edu/home/kleinber/networks-book/)
- Thelwall, M. (2009). Social network sites: Users and uses. In: M. Zelkowitz (Ed.), Advances in Computers 76. Amsterdam: Elsevier (pp. 19-73)

Remarks
New course starting winter term 2015/2016.

Course: Machine Tools and Industrial Handling [2149902]

Coordinators: J. Fleischer
Part of the modules: Machine Tools and Industrial Handling (p. 112)[WI4INGMB32]

ECTS Credits	Hours per week	Type	Term	Instruction language
9	4/2	lecture + exercise	Winter term	de

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

Conditions
None

Recommendations
None

Learning Outcomes
The students . . .

- are capable to explain the use and application of machine tools and handling devices as well as differentiate their characteristics and structure.
- are able to name and describe the essential components (frame, main spindles, feed axis, peripheral equipment, control) of machine tools.
- Are capable to distinguish and select and describe the essential components regarding structure, characteristics advantages and disadvantages.
- are enabled to dimension the main components of machine tools.
- are able to name and describe the control principles of machine tools.
- are capable to name examples of machine tools and industrial handling as well as to deduce compare the essential components. Additionally they can allocate manufacturing processes.
- are enabled to identify drawbacks as well as derive and asses measures for improvements.
- are qualified to apply methods for selection and evaluation of machine tools.
- are experienced to deduce the particular failure characteristics of a ball screw.

Content
The lecture provides an overview of machine tool and handling devices structures, use and application areas. Within the lecture based and industrially oriented knowledge for selection, dimensioning and evaluation is conveyed. First the components of machine tools are explained systematically. Here the distinctive features of dimensioning machine tools are deduced followed by the integral dimensioning of machine tools. Subsequently the use of machine tools is shown in exemplary application areas e.g. turning, milling, grinding, metal forming, sheet metal forming and gear cutting.
The lecture provides an inside view of industrial application and is illustrated with current examples.
The topics are as follows:

- Frame and frame components
- Main drives and main spindles
- Requirements for feed axes
- Electro-mechanical feed axis
- Fluidic feed axes
- Control technologies
- Peripheral components
- Metrological assessment
- Machine maintenance
- Process-diagnosis
- Machinery Directiv
- Machine tool examples

Workload
regular attendance: 63 hours
self-study: 207 hours

Media
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).

Literature
Lecture Notes

Remarks
None

Course: Competition in Networks [2561204]

Coordinators: K. Mitusch
Part of the modules: Network Economics (p. 65)[WI4VWL4]

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

Learning Control / Examinations
Result of success is made by a 60 minutes written examination during the semester break (according to §4(2), 1 ERSC). Examination is offered every semester and can be retried at any regular examination date.

Conditions
None.

Recommendations
Basics of microeconomics obtained within the undergraduate programme (B.Sc) of economics are required. Useful, but not necessary, are basic knowledge of industrial economics, prinicpal agent theory, and contract theory.

Learning Outcomes
The Students

- will get a vivid idea of the special characteristics of network industries like telecom, utilities, IT and transport sectors.
- will acquire the basic economic understanding of network industries concerning competition, competitive distortion, state intervention, pricing and financing
- will be able to apply abstract concepts and formal methods to use in these fields

Content
Network or infrastructure industries like telecommunication, transport, and utilities form the backbone of modern economies. The lecture provides an overview of the economic characteristics of network industries. The planning of networks is complicated by the multitude of aspects involved (like spatial differentiation and the like). The interactions of different companies – competition or cooperation or both – are characterized by complex interdependencies within the networks: network effects, economies of scale, effects of vertical integration, switching costs, standardization, compatibility etc. appear increasingly in these sectors and even tend to appear in combination. Additionally, government interventions can often be observed, partly driven by the aims of competition policy and partly driven by the aims of industrial policy. All these issues are brought up, analyzed formally (in part) and illustrated by several examples in the lecture.

Workload
The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature
Will be announced in the lecture.

Course: Tendering, Planning and Financing in Public Transport [6232807]

Coordinators: W. Weißkopf
Part of the modules: Transportation Modelling and Traffic Management (p. 134)[WI4INGBGU16], Fundamentals of Transportation (p. 133)[WI4INGBGU15]

ECTS Credits	Hours per week	Type	Term	Instruction language
3	2	lecture	Summer term	de

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

Conditions
See module description.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Course: Economic Efficiency of Guided Transport Systems [6234902]

Coordinators: E. Hohnecker, staff
Part of the modules: Track Guided Transport Systems / Engineering (p. 138)[WI4INGBGU27], Project in Public Transportation (p. 136)[WI4INGBGU25], Public Transportation Operations (p. 137)[WI4INGBGU26]

ECTS Credits	Hours per week	Type	Term	Instruction language
1,5	1	lecture	Winter term	de

Learning Control / Examinations
The assessment will consist of a oral exam (10 min) according to §4 (2), 1 of the examination regulation.
The exam is offered each semester. The re-examination is offered upon prior agreement with the interested participants and not later than the next regular examination date.

Conditions
See module description.

Recommendations
See module description.

Learning Outcomes
See German version.

Content
basics of economy, accounting and finance, financing of investments, demand and offer for transportation, transportation market, transport policy

Workload
The total workload for this course is approximately 45.0 hours. For further information see German version.

Remarks
See German version.

Course: Seminar Economic Theory [SemWIOR2]

Coordinators: C. Puppe
Part of the modules: Seminar Module (p. 157)[WI4SEM]

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

Learning Control / Examinations

Conditions
See corresponding module information.
At least one of the courses *Game Theory I* [2520525] and *Welfare Economics* [2520517] should have been attended beforehand.

Learning Outcomes
See German version.

Content

Workload
The total workload for this course is approximately 90 hours. For further information see German version.

Literature
Will be announced at the end of the recess period.

Remarks
see German version.

Course: Workflow-Management [2511204]

Coordinators: A. Oberweis
Part of the modules: Emphasis in Informatics (p. 80)[WI4INFO2], Informatics (p. 78)[WI4INFO1], Electives in Informatics (p. 82)[WI4INFO3]

ECTS Credits	Hours per week	Type	Term	Instruction language
5	2/1	lecture + exercise	Summer term	de

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

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

Learning Outcomes
Students

- explain the concepts and principles of workflow management concepts and systems and their applications,
- create and evaluatel business process models,
- analyze static and dynamic properties of workflows.

Content
A workflow is that part of a business process which is automatically executed by a computerized system. Workflow management includes the design, modelling, analysis, execution and management of workflows. Workflow management systems are standard software systems for the efficient control of processes in enterprises and organizations. Knowledge in the field of workflow management systems is especially important during the design of systems for process support.
The course covers the most important concepts of workflow management. Modelling and design techniques are presented and an overview about current workflow management systems is given. Standards, which have been proposed by the workflow management coalition (WfMC), are discussed. Petri nets are proposed as a formal modelling and analysis tool for business processes. Architecture and functionality of workflow management systems are discussed. The course is a combination of theoretical foundations of workflow management concepts and of practical application knowledge.

Workload
Warning: not a valid latex tabular environment.

Media
Slides, Access to internet resources.

Literature

- W. van der Aalst, H. van Kees: Workflow Management: Models, Methods and Systems, Cambridge 2002: The MIT Press
- M. Weske: Business Process Management: Concepts, Languages, Architectures. Springer 2012.
- A. Oberweis: Modellierung und Ausführung von Workflows mit Petri-Netzen. Teubner-Reihe Wirtschaftsinformatik, B.G. Teubner Verlag, 1996.
- F. Schönthaler, G.Vossen, A. Oberweis, T. Karl: Business Processes for Business Communities: Modeling Languages, Methods, Tools. Springer 2012.
  Further literature is given in the lecture.

Course: „Good Governance“ at German Corporations [2577919]

Coordinators: T. Reitmeyer
Part of the modules: Seminar Module (p. 157)[WI4SEM]

ECTS Credits	Hours per week	Type	Term	Instruction language
6	2	seminar	Winter / Summer Term	de

Learning Control / Examinations
Term paper (50%) and written conclusion (50%).

Conditions
None.

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.

Workload
The total workload for this course is approximately 180 hours. For further information see German version.

Media
Slides.

Literature
The relevant sources are made known during the course.

7 Appendix: Qualification objectives of the Master's program in Industrial Engineering and Management

Graduates of the interdisciplinary Master's program in Industrial Engineering have advanced and in-depth knowledge in business administration, economics, computer science, operations research and engineering. This mainly has its focus on business administration and engineering. The areas of specialization depend on individual interests. Additional knowledge in statistics, law or sociology is also offered depending on one's interests.
They have generalized or specialized expertise in the different disciplines.
The graduates are in a position to define, describe and interpret the specifics, limits, terminologies and doctrines in these subjects, reproduce the current state of research and selectively use this as a basis for further development. Their extensive know-how enables them to think across the various disciplines and approach issues from different angles.
They are able to select and combine appropriate courses of action for research-related topics. They can then transfer and apply these to specific problems. They can separately analyze extensive problems such as information and current challenges and review, compare and evaluate these using appropriate methods and concepts. They evaluate the complexity and risks, identify improvement potentials and choose sustainable solution processes and improvement methods. This puts them in a position where they are able to make responsible and science-based decisions. They are able to come up with innovative ideas and apply them accordingly. They can oversee these approaches either independently or in teams. They are able to explain and discuss their decisions. They can independently interpret, validate and illustrate the obtained results. The interdisciplinary use of knowledge also takes account of social, scientific and ethical insights. The graduates can communicate with expert representatives on a scientific level and assume prominent responsibility in a team. Karlsruhe's industrial engineers are characterized by their interdisciplinary thinking as well as their innovation and management capability. They are particularly qualified for industrial occupations, service sector or in public administration as well as a downstream scientific career (PhD).

Prüfungs- und Studienordnung der Universität Karlsruhe (TH) für den Masterstudiengang Wirtschaftsingenieurwesen

Aufgrund von § 34 Absatz 1 Satz 1 des Landeshochschulgesetzes (LHG) vom 1. Januar 2005 hat der Senat der Universität Karlsruhe (TH) am 26.02.2007 die folgende Studien- und Prüfungsordnung für den Masterstudiengang Wirtschaftsingenieurwesen beschlossen.

Der Rektor hat seine Zustimmung am 06.03.2007 erteilt.

Aus Gründen der Lesbarkeit ist in dieser Satzung nur die männliche Sprachform gewählt worden. Alle personenbezogenen Aussagen gelten jedoch stets für Frauen und Männer gleichermaßen.

Inhaltsverzeichnis

I. Allgemeine Bestimmungen

§ 1 Geltungsbereich, Ziele

(1) Diese Masterprüfungsordnung regelt Studienablauf, Prüfungen und den Abschluss des Studiums im Masterstudiengang Wirtschaftsingenieurwesen an der Universität Karlsruhe (TH).

(2) Im Masterstudium sollen die im Bachelorstudium erworbenen wissenschaftlichen Qualifikationen weiter vertieft oder ergänzt werden. Der Studierende 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.") für den Masterstudiengang Wirtschaftsingenieurwesen verliehen.

§ 3 Regelstudienzeit, Studienaufbau, Leistungspunkte

(1) Die Regelstudienzeit beträgt vier Semester. Sie umfasst Prüfungen und die Masterarbeit.

(2) Die im Studium zu absolvierenden Lehrinhalte sind auf Fächer verteilt. Die Fächer sind in Module gegliedert, die jeweils aus einer Lehrveranstaltung oder mehreren thematisch und zeitlich aufeinander bezogenen Lehrveranstaltungen bestehen. Studienplan oder Modulhandbuch beschreiben Art, Umfang und Zuordnung der Module zu einem Fach sowie die Möglichkeiten, Module untereinander zu kombinieren. Die Fächer und ihr Umfang werden in § 16 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 Leistungspunkte sind in der Regel gleichmäßig auf die Semester zu verteilen.

(6) Lehrveranstaltungen/Prüfungen können auch in englischer Sprache angeboten/abgenommen werden.

§ 4 Aufbau der Prüfungen

(1) Die Masterprüfung besteht aus einer Masterarbeit, Fachprüfungen und einem Seminarmodul. Jede der Fachprüfungen besteht aus einer oder mehreren Modulprüfungen. Eine Modulprüfung kann in mehrere Modulteilprüfungen untergliedert sein. Eine Modul(teil)prüfung besteht aus mindestens einer Erfolgskontrolle nach Absatz 2 Nr. 1 und 2. Ausgenommen hiervon sind Seminarmodule.

(2) Erfolgskontrollen sind:

1. schriftliche Prüfungen,
2. mündliche Prüfungen,
3. Erfolgskontrollen anderer Art.

Erfolgskontrollen anderer Art sind z. B. Vorträge, Marktstudien, Projekte, Fallstudien, Experimente, schriftliche Arbeiten, Berichte, Seminararbeiten und Klausuren, sofern sie nicht als schriftliche oder mündliche Prüfung in der Modul- oder Lehrveranstaltungsbeschreibung im Modulhandbuch ausgewiesen sind.

(3) In den Fachprüfungen (nach § 16 Absatz 2 Nr. 1 bis 6) sind mindestens 50 vom Hundert einer Modulprüfung in Form von schriftlichen oder mündlichen Prüfungen (Absatz 2 Nr. 1 und 2) abzulegen, die restliche Prüfung erfolgt durch Erfolgskontrollen anderer Art (Absatz 2 Nr. 3).

§ 5 Anmeldung und Zulassung zu den Prüfungen

(1) Die Zulassung zu den Prüfungen nach § 4 Absatz 2 Nr. 1 und 2 sowie zur Masterarbeit erfolgt im Studienbüro.

Um zu Prüfungen in einem Modul zugelassen zu werden, muss beim Studienbüro eine bindende Erklärung über die Wahl des betreffenden Moduls und dessen Zuordnung zu einem Fach, wenn diese Wahlmöglichkeit besteht, abgegeben werden.

(2) Die Zulassung darf nur abgelehnt werden, wenn der Studierende in einem mit Wirtschaftsingenieurwesen 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 Erfolgskontrollen (§ 4 Absatz 2 Nr. 1 bis 3) eines Moduls wird im Studienplan oder Modulhandbuch in Bezug auf die Lehrinhalte der betreffenden Lehrveranstaltungen und die Lehrziele des Moduls festgelegt. Die Art der Erfolgskontrollen, ihre Häufigkeit, Reihenfolge und Gewichtung, die Grundsätze zur Bildung der Modulteilprüfungsnoten und der Modulnote sowie Prüfer müssen mindestens sechs Wochen vor Semesterbeginn bekannt gegeben werden. Im Einvernehmen von Prüfer und Studierendem kann die Art der Erfolgskontrolle auch nachträglich geändert werden. Dabei ist jedoch § 4 Absatz 3 zu berücksichtigen.

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

Bei Einvernehmen zwischen Prüfer und Kandidat kann der Prüfungsausschuss in begründeten Ausnahmefällen auch kurzfristig die Änderung der Prüfungsform genehmigen.

Wird die Wiederholungsprüfung einer schriftlichen Prüfung in mündlicher Form abgelegt, entfällt die mündliche Nachprüfung nach § 8 Absatz 2.

(4) Macht ein Studierender glaubhaft, dass er wegen länger andauernder oder ständiger körperlicher Behinderung nicht in der Lage ist, die Erfolgskontrollen ganz oder teilweise in der vorgeschriebenen Form abzulegen, entscheidet der Prüfungsausschuss über eine alternative Form der Erfolgskontrollen.

(5) Bei Lehrveranstaltungen in englischer Sprache werden die entsprechenden Erfolgskontrollen in der Regel in englischer Sprache abgenommen.

(6) Schriftliche Prüfungen (§ 4 Absatz 2 Nr. 1) sind in der Regel von zwei Prüfern nach § 14 Absatz 2 oder § 14 Absatz 3 zu bewerten. Die Note ergibt sich aus dem arithmetischen Mittel der Einzelbewertungen. Entspricht das arithmetische Mittel keiner der in § 7 Absatz 2 Satz 2 definierten Notenstufen, so ist auf die nächstliegende Notenstufe zu runden. Bei gleichem Abstand ist auf die nächst bessere Notenstufe zu runden. Das Bewertungsverfahren soll sechs Wochen nicht überschreiten. Schriftliche Einzelprüfungen dauern in der Regel mindestens 60 und höchstens 240 Minuten.

(7) Mündliche Prüfungen (§ 4 Absatz 2 Nr. 2) sind von mehreren Prüfern (Kollegialprüfung) oder von einem Prüfer in Gegenwart eines Beisitzenden als Gruppen- oder Einzelprüfungen abzu-

nehmen und zu bewerten. Vor der Festsetzung der Note hört der Prüfer die anderen an der Kollegialprüfung mitwirkenden Prüfer an. Mündliche Prüfungen dauern in der Regel mindestens 15 Minuten und maximal 45 Minuten pro Studierendem.

(8) Die wesentlichen Gegenstände und Ergebnisse der mündlichen Prüfung in den einzelnen Fächern sind in einem Protokoll festzuhalten. Das Ergebnis der Prüfung ist dem Studierenden im Anschluss an die mündliche Prüfung bekannt zu geben.

(9) Studierende, die sich in einem späteren Prüfungszeitraum der gleichen Prüfung unterziehen wollen, werden entsprechend den räumlichen Verhältnissen als Zuhörer bei mündlichen Prüfungen zugelassen. Die Zulassung erstreckt sich nicht auf die Beratung und Bekanntgabe der Prüfungsergebnisse. Aus wichtigen Gründen oder auf Antrag des Studierenden 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 dem Studierenden zurechenbar ist.

(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.

(12) Bei mündlich durchgeführten Erfolgskontrollen anderer Art muss neben dem Prüfer ein Beisitzer anwesend sein, der zusätzlich zum Prüfer die Protokolle zeichnet.

§ 7 Bewertung von Prüfungen und Erfolgskontrollen

(1) Das Ergebnis einer Erfolgskontrolle wird von den jeweiligen Prüfern in Form einer Note festgesetzt.

(2) Im Masterzeugnis dürfen nur folgende Noten verwendet werden:

1	=	sehr gut (very good)	=	hervorragende Leistung
2	=	gut (good)	=	eine Leistung, die erheblich über den durchschnittlichen Anforderungen liegt
3	=	befriedigend (satisfactory)	=	eine Leistung, die durchschnittlichen Anforderungen entspricht
4	=	ausreichend (sufficient)	=	eine Leistung, die trotz ihrer Mängel noch den Anforderungen genügt
5	=	nicht ausreichend (failed)	=	eine Leistung, die wegen erheblicher Mängel nicht den Anforderungen genügt

Für die Masterarbeit und die Modulteilprüfungen sind zur differenzierten Bewertung nur folgende Noten zugelassen:

1	=	1.0, 1.3	=	sehr gut
2	=	1.7, 2.0, 2.3	=	gut
3	=	2.7, 3.0, 3.3	=	befriedigend
4	=	3.7, 4.0	=	ausreichend
5	=	4.7, 5.0	=	nicht ausreichend

Diese Noten müssen in den Protokollen und in den Anlagen (Transcript of Records und Diploma Supplement) verwendet werden.

(3) Für Erfolgskontrollen anderer Art kann die Benotung „bestanden” (passed) oder „nicht bestanden” (failed) vergeben werden.

(4) Bei der Bildung der gewichteten Durchschnitte der Fachnoten, 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 jeweils nur einmal angerechnet werden.

(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 oder Modulhandbuch 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 oder Modulhandbuch geregelt. Die differenzierten Noten der betreffenden Erfolgskontrollen sind bei der Berechnung der Modulnoten als Ausgangsdaten zu verwenden. Enthält der Studienplan oder das Modulhandbuch keine Regelung darüber, wann eine Modulprüfung bestanden ist, so ist diese Modulprüfung dann bestanden, wenn alle dem Modul zugeordneten Modulteilprüfungen bestanden wurden.

(9) Eine Fachprüfung ist bestanden, wenn die für das Fach erforderliche Anzahl von Leistungspunkten über die im Studienplan oder Modulhandbuch definierten Modulprüfungen nachgewiesen wird.

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

(10) Die Ergebnisse der Masterarbeit, der Modulprüfungen bzw. der Modulteilprüfungen, der Erfolgskontrollen anderer Art sowie die erworbenen Leistungspunkte werden durch das Studienbüro der Universität erfasst.

(11) Innerhalb der Regelstudienzeit, einschließlich der Urlaubssemester für das Studium an einer ausländischen Hochschule (Regelprüfungszeit), können in einem Fach auch mehr Leistungspunkte erworben werden als für das Bestehen der Fachprüfung erforderlich sind. In diesem Fall werden bei der Festlegung der Fachnote nur die Modulnoten berücksichtigt, die unter Abdeckung der erforderlichen Leistungspunkte die beste Fachnote ergeben.

Die in diesem Sinne für eine Fachprüfung nicht gewerteten Erfolgskontrollen und Leistungspunkte können im Rahmen der Zusatzfachprüfung nach § 12 nachträglich geltend gemacht werden.

(12) Die Gesamtnote der Masterprüfung, die Fachnoten und die Modulnoten lauten:

bis 1,5	=	sehr gut
1.6 bis 2.5	=	gut
2.6 bis 3.5	=	befriedigend
3.6 bis 4.0	=	ausreichend

(13) 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	10	gehört zu den besten 10 % der Studierenden, die die Erfolgskontrolle bestanden haben
B	25	gehört zu den nächsten 25 % der Studierenden, die die Erfolgskontrolle bestanden haben
C	30	gehört zu den nächsten 30 % der Studierenden, die die Erfolgskontrolle bestanden haben
D	25	gehört zu den nächsten 25 % der Studierenden, die die Erfolgskontrolle bestanden haben
E	10	gehört zu den letzten 10 % der Studierenden, die die Erfolgskontrolle bestanden haben
FX		nicht bestanden (failed) – es sind Verbesserungen erforderlich, bevor die Leistungen anerkannt werden
F		nicht bestanden (failed) – es sind erhebliche Verbesserungen erforderlich

Die Quote ist als der Prozentsatz der erfolgreichen Studierenden definiert, die diese Note in der Regel erhalten. Dabei ist von einer mindestens fünfjährigen Datenbasis über mindestens 30 Studierende auszugehen. Für die Ermittlung der Notenverteilungen, die für die ECTS-Noten erforderlich sind, ist das Studienbüro der Universität zuständig.

§ 8 Erlöschen des Prüfungsanspruchs, Wiederholung von Prüfungen und Erfolgskontrollen

(1) Studierende können eine nicht bestandene schriftliche Prüfung (§ 4 Absatz 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 4.0 (ausreichend) sein.

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

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

(4) Die Wiederholung einer Erfolgskontrolle anderer Art (§ 4 Absatz 2 Nr. 3) wird im Modulhandbuch geregelt.

(5) Eine zweite Wiederholung derselben schriftlichen oder mündlichen Prüfung ist nur in Ausnahmefällen zulässig. Einen Antrag auf Zweitwiederholung hat der Studierende schriftlich beim Prüfungsausschuss zu stellen. Über den ersten Antrag auf Zweitwiederholung entscheidet der Prüfungsausschuss, wenn er den Antrag genehmigt. Wenn der Prüfungsausschuss diesen Antrag ablehnt, entscheidet der Rektor. Über weitere Anträge auf Zweitwiederholung entscheidet nach Stellungnahme des Prüfungsausschusses der Rektor. Absatz 1 Satz 2 und Satz 3 gilt entsprechend.

Bei nicht bestandener Erfolgskontrolle sind dem Kandidaten Umfang und Frist der Wiederholung in geeigneter Weise bekannt zu machen.

(6) Die Wiederholung einer bestandenen Erfolgskontrolle ist nicht zulässig.

(7) Eine Fachprüfung ist nicht bestanden, wenn mindestens ein Modul des Faches 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 Absatz 2 Satz 3 LHG die Masterprüfung bis zum Beginn der Vorlesungszeit des achten Fachsemesters einschließlich etwaiger Wiederholungen nicht vollständig abgelegt, so erlischt der Prüfungsanspruch im Studiengang, es sei denn, dass der Studierende die Fristüberschreitung nicht zu vertreten hat. Die Entscheidung darüber trifft der Prüfungsausschuss.

(10) Der Prüfungsanspruch erlischt endgültig, wenn mindestens einer der folgenden Gründe vorliegt:

1. Der Prüfungsausschuss lehnt einen Antrag auf Fristverlängerung nach Absatz 9 ab.
2. Die Masterarbeit ist endgültig nicht bestanden.
3. Eine Erfolgskontrolle nach § 4 Absatz 2 Nr. 1 und 2 ist in einem Fach endgültig nicht bestanden.
4. Der Prüfungsausschuss hat dem Studierenden nach § 9 Absatz 5 den Prüfungsanspruch entzogen.

Eine Erfolgskontrolle ist dann endgültig nicht bestanden, wenn keine Wiederholungsmöglichkeit im Sinne von Absatz 2 mehr besteht oder gemäß Absatz 5 genehmigt wird. Dies gilt auch sinngemäß für die Masterarbeit.

§ 9 Versäumnis, Rücktritt, Täuschung, Ordnungsverstoß

(1) Der Studierende kann bei Erfolgskontrollen gemäß § 4 Absatz 2 Nr. 1 ohne Angabe von Gründen noch vor Ausgabe der Prüfungsaufgaben zurücktreten. Bei mündlichen Erfolgskontrollen muss der Rücktritt spätestens drei Werktage vor dem betreffenden Prüfungstermin erklärt werden. Die verbindlichen Regelungen zur ordentlichen Abmeldung werden gemäß § 6 Absatz 2 bekannt gegeben. Eine durch Widerruf abgemeldete Prüfung gilt als nicht angemeldet.

(2) Eine Modulprüfung wird mit „nicht ausreichend" bewertet, wenn der Studierende einen Prüfungstermin ohne triftigen Grund versäumt oder wenn er 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, der Studierende 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 des Studierenden oder eines von ihm allein zu versorgenden Kindes oder pflegebedürftigen Angehörigen kann in Zweifelsfällen die Vorlage des Attestes eines vom Prüfungsausschuss benannten Arztes oder 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 der Studierende das Ergebnis einer Erfolgskontrolle durch Täuschung oder Benutzung nicht zugelassener Hilfsmittel zu beeinflussen, gilt die betreffende Erfolgskontrolle als mit „nicht ausreichend” (5.0) bewertet.

(5) Ein Studierender, der den ordnungsgemäßen Ablauf der Prüfung stört, kann vom jeweiligen Prüfer oder der aufsichtsführenden Person von der Fortsetzung der Modulprüfung ausgeschlossen werden. In diesem Fall wird die betreffende Prüfungsleistung mit „nicht ausreichend" (5.0) bewertet. In schwerwiegenden Fällen kann der Prüfungsausschuss den Studierenden von der Erbringung weiterer Prüfungsleistungen ausschließen.

(6) Der Studierende kann innerhalb einer Frist von einem Monat verlangen, dass Entscheidungen gemäß Absatz 4 und Absatz 5 vom Prüfungsausschuss überprüft werden. Belastende Entscheidungen des Prüfungsausschusses sind unverzüglich schriftlich mitzuteilen. Sie sind zu begründen und mit einer Rechtsbehelfsbelehrung zu versehen. Vor einer Entscheidung ist Gelegenheit zur Äußerung zu geben.

(7) Näheres regelt die Allgemeine Satzung der Universität Karlsruhe (TH) über die Redlichkeit bei Prüfungen und Praktika.

§ 10 Mutterschutz, Elternzeit

(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. Der Studierende muss bis spätestens vier Wochen vor dem Zeitpunkt, von dem er die Elternzeit antreten will, dem Prüfungsausschuss unter Beifügung der erforderlichen Nachweise schriftlich mitteilen, in welchem Zeitraum er Elternzeit in Anspruch nehmen will. Der Prüfungsausschuss hat zu prüfen, ob die gesetzlichen Voraussetzungen vorliegen, die bei einem Arbeitnehmer den Anspruch auf Elternzeit auslösen würden, und teilt dem Studierenden das Ergebnis sowie die neu festgesetzten Prüfungszeiten unverzüglich mit. Die Bearbeitungszeit der Masterarbeit kann nicht durch Elternzeit unterbrochen werden. Die gestellte Arbeit gilt als nicht vergeben. Nach Ablauf der Elternzeit erhält der Studierende ein neues Thema.

§ 11 Masterarbeit

(1) Voraussetzung für die Zulassung zur Masterarbeit ist, dass der Studierende sich in der Regel im 2. Studienjahr befindet und nicht mehr als vier der Fachprüfungen laut § 16 Absatz 2 Nr. 1 bis 6 noch nachzuweisen sind.

Vor Zulassung sind Betreuer, Thema und Anmeldedatum dem Prüfungsausschuss bekannt zu geben und im Falle einer Betreuung außerhalb der Fakultät für Wirtschaftswissenschaften durch den Prüfungsausschuss zu genehmigen.

Auf Antrag des Studierenden sorgt der Vorsitzende des Prüfungsausschusses dafür, dass der Studierende innerhalb von vier Wochen nach Antragstellung von einem Betreuer ein Thema für die Masterarbeit erhält. Die Ausgabe des Themas erfolgt in diesem Fall über den Vorsitzenden des Prüfungsausschusses.

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

(3) Der Masterarbeit werden 30 Leistungspunkte zugeordnet. Die empfohlene Bearbeitungsdauer beträgt sechs Monate. Die maximale Bearbeitungsdauer beträgt einschließlich einer Verlängerung neun Monate. Die Masterarbeit soll zeigen, dass der Studierende in der Lage ist, ein Problem aus seinem Fach selbstständig und in begrenzter Zeit nach wissenschaftlichen Methoden zu bearbeiten. Sie kann auch in englischer Sprache abgefasst werden.

(4) Die Masterarbeit kann von jedem Prüfer nach § 14 Absatz 2 vergeben und betreut werden. Soll die Masterarbeit außerhalb der Fakultät angefertigt werden, so bedarf dies der Genehmigung des Prüfungsausschusses gemäß Absatz 1. Dem Studierenden ist Gelegenheit zu geben,

für das Thema Vorschläge zu machen. Die Masterarbeit kann auch in Form einer Gruppenarbeit zugelassen werden, wenn der als Prüfungsleistung zu bewertende Beitrag des einzelnen Studierenden aufgrund objektiver Kriterien, die eine eindeutige Abgrenzung ermöglichen, deutlich unterscheidbar ist und die Anforderung nach Absatz 3 erfüllt.

(5) Bei der Abgabe der Masterarbeit hat der Studierende schriftlich zu versichern, dass er die Arbeit selbstständig verfasst hat und keine anderen als die 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 beim Prüfungsausschuss aktenkundig zu machen. Das Thema kann nur einmal und nur innerhalb des ersten Monats der Bearbeitungszeit zurückgegeben werden. Ein neues Thema ist binnen vier Wochen zu stellen und auszugeben. Auf begründeten Antrag des Studierenden kann der Prüfungsausschuss die in Absatz 3 festgelegte Bearbeitungszeit um höchstens drei Monate verlängern. Wird die Masterarbeit nicht fristgerecht abgeliefert, gilt sie als mit „nicht ausreichend" bewertet, es sei denn, dass der Studierende dieses Versäumnis nicht zu vertreten hat. § 8 gilt entsprechend.

(7) Die Masterarbeit wird von einem Betreuer sowie in der Regel von einem weiteren Prüfer bewertet. Einer der beiden muss Juniorprofessor oder Professor sein. Bei nicht übereinstimmender Beurteilung der beiden Prüfer setzt der Prüfungsausschuss im Rahmen der Bewertung der beiden Prüfer die Note der Masterarbeit fest. Der Bewertungszeitraum soll acht Wochen nicht überschreiten.

§ 12 Zusatzmodule, Zusatzleistungen

(1) Der Studierende kann sich weiteren Prüfungen in Modulen unterziehen. § 3, § 4 und § 8 Absatz 10 der Prüfungsordnung bleiben davon unberührt.

(2) Maximal zwei Zusatzmodule mit jeweils mindestens neun Leistungspunkten werden auf Antrag des Studierenden in das Masterzeugnis aufgenommen und entsprechend gekennzeichnet.

Zusatzmodule müssen nicht im Studienplan oder Modulhandbuch definiert sein. Im Zweifelsfall entscheidet der Prüfungsausschuss.

Zusatzmodule werden bei der Festsetzung der Gesamtnote nicht mit einbezogen. Alle Zusatzleistungen werden im Transcript of Records automatisch aufgenommen und als Zusatzleistungen gekennzeichnet. Zusatzleistungen werden mit den nach § 7 vorgesehenen Noten gelistet. Diese Zusatzleistungen gehen nicht in die Festsetzung der Gesamt-, Fach- und Modulnoten ein.

(3) Der Studierende hat bereits bei der Anmeldung zu einer Prüfung in einem Modul diese als Zusatzleistung zu deklarieren.

§ 13 Prüfungsausschuss

(1) Für den Masterstudiengang Wirtschaftsingenieurwesen wird ein Prüfungsausschuss gebildet. Er besteht aus fünf stimmberechtigten Mitgliedern: vier Professoren, Juniorprofessoren, Hochschul- oder Privatdozenten, einem Vertreter der Gruppe der wissenschaftlichen Mitarbeiter nach § 10 Absatz 1 Satz 2 Nr. 2 LHG und einem Vertreter der Studierenden mit beratender Stimme. Die Amtszeit der nichtstudentischen Mitglieder beträgt zwei Jahre, die des studentischen Mitglieds ein Jahr.

(2) Der Vorsitzende, sein Stellvertreter, die weiteren Mitglieder des Prüfungsausschusses sowie deren Stellvertreter werden vom Fakultätsrat bestellt, die Mitglieder der Gruppe der wissenschaftlichen Mitarbeiter nach § 10 Absatz 1 Satz 2 Nr. 2 LHG und der Vertreter der Studierenden

auf Vorschlag der Mitglieder der jeweiligen Gruppe; Wiederbestellung ist möglich. Der Vorsitzende und dessen Stellvertreter müssen Professor oder Juniorprofessor sein. Der Vorsitzende des Prüfungsausschusses nimmt die laufenden Geschäfte wahr und wird durch ein Prüfungssekretariat unterstützt.

(3) Der Prüfungsausschuss regelt die Auslegung und die Umsetzung der Prüfungsordnung in die Prüfungspraxis der Fakultät. Er achtet darauf, dass die Bestimmungen der Prüfungsordnung eingehalten werden. Er berichtet regelmäßig dem Fakultätsrat über die Entwicklung der Prüfungen und Studienzeiten sowie über die Verteilung der Fach- und Gesamtnoten und gibt Anregungen zur Reform des Studienplans und der Prüfungsordnung.

(4) Der Prüfungsausschuss kann die Erledigung seiner Aufgaben in dringenden Angelegenheiten und für alle Regelfälle auf den Vorsitzenden des Prüfungsausschusses übertragen.

(5) Die Mitglieder des Prüfungsausschusses haben das Recht, an Prüfungen teilzunehmen. Die Mitglieder des Prüfungsausschusses, die Prüfer und die Beisitzenden unterliegen der Amtsverschwiegenheit. Sofern sie nicht im öffentlichen Dienst stehen, sind sie durch den Vorsitzenden 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 ein fachlich zuständiger und von der betroffenen Fakultät zu nennender Professor, Juniorprofessor, Hochschul- oder Privatdozent hinzuzuziehen. Er hat in diesem Punkt Stimmrecht.

(7) Belastende Entscheidungen des Prüfungsausschusses sind 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 an den Prüfungsausschuss zu richten. Hilft der Prüfungsausschuss dem Widerspruch nicht ab, ist er zur Entscheidung dem für die Lehre zuständigen Mitglied des Rektorats vorzulegen.

§ 14 Prüfer und Beisitzende

(1) Der Prüfungsausschuss bestellt die Prüfer und die Beisitzenden. Er kann die Bestellung dem Vorsitzenden übertragen.

(2) Prüfer sind Hochschullehrer und habilitierte Mitglieder sowie wissenschaftliche Mitarbeiter der jeweiligen Fakultät, denen die Prüfungsbefugnis übertragen wurde. Bestellt werden darf nur, wer mindestens die dem jeweiligen Prüfungsgegenstand entsprechende fachwissenschaftliche Qualifikation erworben hat. Bei der Bewertung der Masterarbeit muss ein Prüfer Hochschullehrer sein.

(3) Soweit Lehrveranstaltungen von anderen als den unter Absatz 2 genannten Personen durchgeführt werden, sollen diese zum Prüfer bestellt werden, wenn die Fakultät ihnen eine diesbezügliche Prüfungsbefugnis erteilt hat.

(4) Zum Beisitzenden darf nur bestellt werden, wer einen dem jeweiligen Prüfungsgegenstand entsprechenden akademischen Abschluss erworben hat.

§ 15 Anrechnung von Studienzeiten, Anerkennung von Studienleistungen und Modulprüfungen

(1) Studienzeiten und gleichwertige Studienleistungen und Modulprüfungen, die in gleichen oder anderen Studiengängen an anderen Hochschulen erbracht wurden, werden auf Antrag angerechnet. 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, so werden die Noten – soweit die Notensysteme vergleichbar sind – übernommen und in die Berechnung der Modulnoten und der Gesamtnote einbezogen. Falls es sich dabei um Leistungen handelt, die im Rahmen eines Auslandsstudiums erbracht werden, während der Studierende an der Universität Karlsruhe (TH) für Wirtschaftsingenieurwesen immatrikuliert ist, kann der Prüfungsausschuss für ausgewählte Sprachen die Dokumentation anerkannter Studienleistungen im Transcript of Records mit ihrer fremdsprachlichen Originalbezeichnung festlegen. Liegen keine Noten vor, wird die Leistung nicht anerkannt. Der Studierende 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 mehr als die Hälfte der erforderlichen Leistungspunkte und/oder die Masterarbeit anerkannt werden sollen.

(6) Zuständig für die Anrechnungen ist der Prüfungsausschuss. Vor Feststellungen über die Gleichwertigkeit sind die zuständigen Fachvertreter 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

§ 16 Umfang und Art der Masterprüfung

(1) Die Masterprüfung besteht aus den Fachprüfungen nach Absatz 2, einem Seminarmodul nach Absatz 3 sowie der Masterarbeit nach § 11.

(2) Es sind Fachprüfungen im Umfang von neun Modulen mit je neun Leistungspunkten abzulegen. Die Module verteilen sich wie folgt auf die Fächer:

1. Betriebswirtschaftslehre: zwei Module im Umfang von je 9 Leistungspunkten,
2. Volkswirtschaftslehre: ein Modul im Umfang von 9 Leistungspunkten,
3. Informatik: ein Modul im Umfang von 9 Leistungspunkten,
4. Operations Research: ein Modul im Umfang von 9 Leistungspunkten,
5. Ingenieurwissenschaften: zwei Module im Umfang von je 9 Leistungspunkten,
6. Wahlbereich: zwei Module im Umfang von je 9 Leistungspunkten aus den Fächern Betriebswirtschaftslehre, Volkswirtschaftslehre, Informatik, Operations Research, Statistik, Ingenieurwissenschaften, Recht und Soziologie. Auf die Fächer Recht und Soziologie darf dabei in Summe höchstens ein Modul entfallen.

(3) Ferner sind im Rahmen des Seminarmoduls bestehend aus zwei Seminaren mindestens sechs Leistungspunkte nachzuweisen. Neben den hier im Umfang von drei Leistungspunkten vermittelten Schlüsselqualifikationen müssen zusätzliche Schlüsselqualifikationen im Umfang von mindestens drei Leistungspunkten erworben werden.

(4) Die Module, die ihnen zugeordneten Lehrveranstaltungen und Leistungspunkte sowie die Zuordnung der Module zu Fächern sind im Studienplan oder im Modulhandbuch geregelt.

Studienplan oder Modulhandbuch können auch Mehrfachmodule definieren, die aus 18 Leistungspunkten (Doppelmodul) bzw. 27 Leistungspunkten (Dreifachmodul) bestehen und für Fachprüfungen nach 1. bis 6. bei in Summe mindestens gleicher Leistungspunktezahl entsprechend anrechenbar sind. Auch die Mehrfachmodule mit ihren zugeordneten Lehrveranstaltungen, Leistungspunkten und Fächern bzw. Fächerkombinationen sind im Studienplan oder Modulhandbuch geregelt.

(5) Im Studienplan oder Modulhandbuch können darüber hinaus inhaltliche Schwerpunkte definiert werden, denen Module zugeordnet werden können.

Legen die Studierenden ihre Fachprüfungen nach Absatz 2 und 3 in Modulen ab, die nach Art und Umfang den im Studienplan oder Modulhandbuch definierten Anforderungen an diese inhaltlichen Schwerpunkte entsprechen, und wird darüber hinaus die Masterarbeit diesem inhaltlichen Schwerpunkt zugeordnet, so wird der inhaltliche Schwerpunkt auf Antrag des Studierenden in das Diploma Supplement aufgenommen.

§ 17 Bestehen der Masterprüfung, Bildung der Gesamtnote

(1) Die Masterprüfung ist bestanden, wenn alle in § 16 genannten Prüfungsleistungen mindestens mit „ausreichend" bewertet wurden.

(2) Die Gesamtnote der Masterprüfung errechnet sich als ein mit Leistungspunkten gewichteter Notendurchschnitt. Dabei werden die Fachprüfungen nach § 16 Absatz 2, das Seminarmodul nach § 16 Absatz 3 und die Masterarbeit nach § 11 mit ihren Leistungspunkten gewichtet.

(3) Hat der Studierende die Masterarbeit mit der Note 1.0 und die Masterprüfung mit einem Durchschnitt von 1.1 oder besser abgeschlossen, so wird das Prädikat „mit Auszeichnung" (with distinction) verliehen.

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

(1) Über die Masterprüfung wird 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 Masterzeugnis tragen das Datum der letzten nachgewiesenen Prüfungsleistung. Sie werden dem Studierenden gleichzeitig ausgehändigt. In der Masterurkunde wird die Verleihung des akademischen Mastergrades beurkundet. Die Masterurkunde wird vom Rektor und vom Dekan unterzeichnet und mit dem Siegel der Universität versehen.

(2) Das Zeugnis enthält die in den Fachprüfungen, den Modulprüfungen sowie dem Seminarmodul und der Masterarbeit erzielten Noten, deren zugeordnete Leistungspunkte und ECTS-Noten und die Gesamtnote und die ihr entsprechende ECTS-Note. Das Zeugnis ist vom Dekan der Fakultät und vom Vorsitzenden des Prüfungsausschusses zu unterzeichnen.

(3) Weiterhin erhält der Studierende 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 des Studierenden (Transcript of Records) sowie auf Antrag des Studierenden einen möglichen inhaltlichen Schwerpunkt gemäß § 16 Absatz 4.

(4) Die Abschrift der Studiendaten (Transcript of Records) enthält in strukturierter Form alle erbrachten Prüfungsleistungen. Dies 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 sowie

bei entsprechendem Antrag des Studierenden zum möglichen inhaltlichen Schwerpunkt gemäß § 16 Absatz 4 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

§ 19 Bescheid über Nicht-Bestehen, Bescheinigung von Prüfungsleistungen

(1) Der Bescheid über die endgültig nicht bestandene Masterprüfung wird dem Studierenden durch den Prüfungsausschuss in schriftlicher Form erteilt. Der Bescheid ist mit einer Rechtsbehelfsbelehrung zu versehen.

(2) Hat der Studierende die Masterprüfung endgültig nicht bestanden, wird ihm 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.

§ 20 Aberkennung des Mastergrades

(1) Hat der Studierende bei einer Prüfungsleistung getäuscht und wird diese Tatsache nach der Aushändigung des Zeugnisses bekannt, so können die Noten der Modulprüfungen, bei denen getäuscht wurde, berichtigt werden. Gegebenenfalls kann die Modulprüfung für „nicht ausreichend” (5.0) und die Masterprüfung für „nicht bestanden“ erklärt werden.

(2) Waren die Voraussetzungen für die Zulassung zu einer Prüfung nicht erfüllt, ohne dass der Studierende darüber täuschen wollte, und wird diese Tatsache erst nach Aushändigung des Zeugnisses bekannt, wird dieser Mangel durch das Bestehen der Prüfung geheilt. Hat der Studierende die Zulassung vorsätzlich zu Unrecht erwirkt, so kann die Modulprüfung für „nicht ausreichend” (5.0) und die Masterprüfung für „nicht bestanden“ erklärt werden.

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

(4) Das unrichtige Zeugnis ist zu entziehen und gegebenenfalls ein neues zu erteilen. Mit dem unrichtigen Zeugnis ist auch die Masterurkunde einzuziehen, wenn die Masterprüfung auf Grund 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.

§ 21 Einsicht in die Prüfungsakten

(1) Nach Abschluss der Masterprüfung wird dem Studierenden auf Antrag innerhalb eines Jahres Einsicht in seine Masterarbeit, die darauf bezogenen Gutachten und in die Prüfungsprotokolle gewährt.

(2) Die Einsichtnahme in die schriftlichen Modulprüfungen bzw. Prüfungsprotokolle erfolgt zu einem durch den Prüfer festgelegten, angemessenen Termin innerhalb der Vorlesungszeit. Der Termin ist mit einem Vorlauf von mindestens 14 Tagen anzukündigen und angemessen bekannt zu geben.

(3) Prüfungsunterlagen sind mindestens fünf Jahre aufzubewahren.

§ 22 In-Kraft-Treten

(1) Diese Studien- und Prüfungsordnung tritt am 1. Oktober 2007 in Kraft.

(2) Gleichzeitig tritt die Prüfungsordnung der Universität Karlsruhe (TH) für den Diplomstudiengang Wirtschaftsingenieurwesen vom 15. November 2001 (Amtliche Bekanntmachung der Universität Karlsruhe (TH), Nr. 29 vom 24. November 2001), zuletzt geändert durch Satzung vom 4. Juli 2004 (Amtliche Bekanntmachung der Universität Karlsruhe (TH), Nr. 36 vom 14. Juli 2004) außer Kraft, behält jedoch ihre Gültigkeit bis zum 30. September 2013 für Prüflinge, die auf Grundlage der Prüfungsordnung der Universität Karlsruhe (TH)) für den Studiengang Wirtschaftsingenieurwesen vom 15. November 2001 (Amtliche Bekanntmachung der Universität Karlsruhe (TH), Nr. 29 vom 24. November 2001) ihr Studium an der Universität Karlsruhe (TH) aufgenommen haben. Über eine Fristverlängerung darüber hinaus entscheidet der Prüfungsausschuss auf Antrag des Studierenden.

Über einen Antrag an den Prüfungsausschuss können Studierende, die auf Grundlage der Prüfungsordnung der Universität Karlsruhe (TH) für den Studiengang Wirtschaftsingenieurwesen vom 15. November 2001 (Amtliche Bekanntmachung der Universität Karlsruhe (TH), Nr. 29 vom 24. November 2001) ihr Studium an der Universität Karlsruhe (TH) aufgenommen haben, ihr Studium auf Grundlage dieser Prüfungsordnung fortsetzen. Der Prüfungsausschuss stellt dabei fest, ob und wie die bisher erbrachten Prüfungsleistungen in den neuen Studienplan integriert werden können und nach welchen Bedingungen das Studium nach einem Wechsel fortgeführt werden kann.

Karlsruhe, den 06.03.2007

Professor Dr. sc. tech. Horst Hippler
(Rektor)

Aufbau des Masterstudiengangs Wirtschaftsingenieurwesen

Die Regelstudienzeit im Masterstudiengang Wirtschaftsingenieurwesen beträgt vier Semester. Im Masterstudium sollen die im Bachelorstudium erworbenen wissenschaftlichen Qualifikationen weiter vertieft oder ergänzt werden. Der Studierende soll in die Lage versetzt werden, die wissenschaftlichen Erkenntnisse und Methoden selbstständig anzuwenden und ihre Bedeutung und Reichweite bei der Lösung komplexer wissenschaftlicher und gesellschaftlicher Problemstellungen zu bearbeiten.

Ferner sind im Rahmen des Seminarmoduls bestehend aus zwei Seminaren mindestens sechs Leistungspunkte nachzuweisen. Neben den hier im Umfang von drei Leistungspunkten vermittelten Schlüsselqualifikationen müssen zusätzliche Schlüsselqualifikationen im Umfang von mindestens drei Leistungspunkten erworben werden.

Die folgende Abbildung zeigt die Fach- und Modulstruktur und die Zuordnung der Leistungspunkte (LP) zu den Fächern. Im Wahlpflichtbereich sind zwei Module aus den Fächern Betriebswirtschaftslehre, Volkswirtschaftslehre, Informatik, Operations Research, Ingenieurwissenschaften, Statistik, Recht und Soziologie zu wählen. Auf die Fächer Recht und Soziologie darf aber in Summe höchstens ein Modul entfallen.

<table>
<tr><th>Semester</th><th></th><th></th><th></th><th></th><th>Summe LP</th></tr>
<tr><td>1.</td><td>Modul
BWL
9</td><td>Modul
ING
9</td><td>Modul
Info
9</td><td rowspan="4">Modul Wahlpflicht 9</td><td>30</td></tr>
<tr><td>2.</td><td>Modul
VWL
9</td><td>Modul
ING
9</td><td>Modul
OR
9</td><td>30</td></tr>
<tr><td>3.</td><td>Modul
BWL
8</td><td>Modul
Wahlpflicht
9</td><td>Modul
Seminare + SQ
6 + 3</td><td>30</td></tr>
<tr><td>4.</td><td colspan="3">Masterarbeit
30</td><td>30
Gesamt: 120</td></tr>
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