Economics Engineering (M.Sc.)
Winter Term 2014/2015
Short version
Date: 21.08.2014
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# Structure of the Master Programme in Economics Engineering (M.Sc.)

The master programme in Economics Engineering (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.

<table>
<thead>
<tr>
<th>Semester</th>
<th>Compulsory</th>
<th>Elective (4 out of)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EC</td>
<td>EC</td>
</tr>
<tr>
<td></td>
<td>EC</td>
<td>BA</td>
</tr>
<tr>
<td></td>
<td>INFO</td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>Seminar</td>
<td>+ KS</td>
</tr>
<tr>
<td>2</td>
<td>STAT</td>
<td>EC</td>
</tr>
<tr>
<td></td>
<td>BA</td>
<td>INFO</td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td>LAW</td>
</tr>
<tr>
<td></td>
<td>o. SOCIO</td>
<td>ENG/NS</td>
</tr>
</tbody>
</table>

| 3        | 6 + 3 LP   | 9 LP               |
|          | 9 LP       | 9 LP               |
|          | 9 LP       | 9 LP               |
|          | 9 LP       | 9 LP               |
|          | 9 LP       | 9 LP               |
|          | 9 LP       | 9 LP               |
| 4        | Master Thesis 30 LP | |

120 LP 
(6 compulsory modules + 4 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 four elective modules of the mentioned disciplines. Thereby it is only possible to select a maximum of two modules from the same discipline and 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 Economics Engineering (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 programme 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

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

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

Figure 2: Key Skills
## 2 KEY SKILLS

**Table:**

<table>
<thead>
<tr>
<th>Was</th>
<th>Wann</th>
<th>Hilfsmittel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auswahl eines Kurses aus dem HoC-Angebot (Wahlbereich 1 – 5)</td>
<td>Ab September (WS) bzw. März (SS)</td>
<td><a href="http://www.hoc.kit.edu">www.hoc.kit.edu</a> oder StudiPortal</td>
</tr>
<tr>
<td>Online-Anmeldung zum Kurs direkt beim HoC (bzw. ZAK, SPZ, ...)</td>
<td>Mittwoch vor Vorlesungsbeginn („first come, first served“!)</td>
<td><a href="http://www.hoc.kit.edu">www.hoc.kit.edu</a> (und dann je nach Kursart)</td>
</tr>
<tr>
<td>Mitteilung an Kursleiter über Kursziel von 3 ECTS</td>
<td>Zum Kursbeginn</td>
<td>Prüfungsordnung (bei WiIng, TVWL werden max. 3 ECTS anerkannt)</td>
</tr>
<tr>
<td>Ablegen und Bestehen der Erfolgskontrolle (im Umfang von 3 ECTS)</td>
<td>Am Kursende</td>
<td></td>
</tr>
<tr>
<td>HoC stellt „Schein“ aus, der vom Studierenden am HoC abgeholt wird</td>
<td>Nach Bestehen der Erfolgskontrolle</td>
<td></td>
</tr>
<tr>
<td>Einreichung des „Scheins“ beim Studienbüro</td>
<td>Nach Abholung des Scheins beim HoC</td>
<td></td>
</tr>
<tr>
<td>Prüfung und ggf. Rückfragen an Prüfungsamt WiWi (Herr Hilser)</td>
<td>So schnell wie möglich</td>
<td></td>
</tr>
<tr>
<td>Verbuchung der SQ im Seminarmodul durch Studienbüro</td>
<td>So schnell wie möglich</td>
<td>Zentrales Prüfungssystem (anschl. Anzeige im StudiPortal)</td>
</tr>
</tbody>
</table>

**Diagram:**

Figure 3: Process of gaining additive key skills

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*Stand: 25.02.2011*

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**Module Handbook, Date: 21.08.2014**
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 handbook 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. The following functions can be accessed on https://studium.kit.edu/meinsemester/Seiten/pruefungsanmeldung.aspx:

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

For further and more detailed information also see https://studium.kit.edu/Seiten/FAQ.aspx

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**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>LP/CP</td>
<td>Credit Points/ECTS</td>
</tr>
<tr>
<td>LV</td>
<td>course</td>
</tr>
<tr>
<td>RÜ</td>
<td>computing lab</td>
</tr>
<tr>
<td>S</td>
<td>summer term</td>
</tr>
<tr>
<td>Sem.</td>
<td>semester/term</td>
</tr>
<tr>
<td>ER/SPO</td>
<td>examination regulations</td>
</tr>
<tr>
<td>KS/SQ</td>
<td>key skills</td>
</tr>
<tr>
<td>SWS</td>
<td>contact hour</td>
</tr>
<tr>
<td>Ü</td>
<td>exercise course</td>
</tr>
<tr>
<td>V</td>
<td>lecture</td>
</tr>
<tr>
<td>W</td>
<td>winter term</td>
</tr>
</tbody>
</table>

Leistungspunkte/ECTS
Lehrveranstaltung
Rechnerübung
Sommersemester
Semester
Studien- und Prüfungsordnung
Schlüsselqualifikationen
Semesterwochenstunde
Übung
Vorlesung
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](http://www.wiwi.kit.edu/lehreMHB.php#mhb_aktuell).

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Semester</th>
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<tbody>
<tr>
<td>TVWL4VWL10</td>
<td>Telecommunications Markets</td>
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<tr>
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<td>TVWL4BWLFBV12</td>
<td>Computational Finance</td>
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<tr>
<td>TVWL4BWLUO1</td>
<td>Strategic Corporate Management and Organization</td>
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</tr>
<tr>
<td>TVWL4BWLUO3</td>
<td>Strategic Decision Making and Organization</td>
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</tr>
<tr>
<td>TVWL4BWLIBU2</td>
<td>Cross-functional Management Accounting</td>
<td>38</td>
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<tr>
<td>TVWL4BWLISM1</td>
<td>Advanced CRM</td>
<td>39</td>
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<tr>
<td>TVWL4BWLISM2</td>
<td>Electronic Markets</td>
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<tr>
<td>TVWL4BWLISM4</td>
<td>Business &amp; Service Engineering</td>
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</tr>
<tr>
<td>TVWL4BWLISM5</td>
<td>Communications &amp; Markets</td>
<td>44</td>
</tr>
</tbody>
</table>

### Anmerkungen

- **TVWL4VWL10 - Telecommunications Markets (S. 20)**
  - The module will be offered latest until SS 2014.

- **TVWL4VWL18 - Advanced Topics in Public Finance (S. 28)**
  - The module will be offered from winter term 2014/15.

- **TVWL4BWLFBV12 - Computational Finance (S. 32)**
  - The module will be offered from winter term 2014/15.
  - The course of the module is held in English.

- **TVWL4BWLUO1 - Strategic Corporate Management and Organization (S. 35)**
  - The course “Organization Theory” will not be offered in winter term 2014/15.

- **TVWL4BWLUO3 - Strategic Decision Making and Organization (S. 36)**
  - The course “Organization Theory” will not be offered in winter term 2014/15.

- **TVWL4BWLIBU2 - Cross-functional Management Accounting (S. 38)**
  - The module will be offered from winter term 2014/15.

- **TVWL4BWLISM1 - Advanced CRM (S. 39)**
  - 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/](http://www.em.uni-karlsruhe.de/studies/).

- **TVWL4BWLISM2 - Electronic Markets (S. 40)**
  - The course Electronic Marktes: Principles is not offered at the moment. The last exam takes place at the end of summer term 14.

- **TVWL4BWLISM4 - Business & Service Engineering (S. 43)**
  - All practical Seminars offered at the IM can be chosen for Special Topics in Information Engineering & Management. Please update yourself on [www.ism.kit.edu/im/lehre](http://www.ism.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/](http://www.em.uni-karlsruhe.de/studies/).

- **TVWL4BWLISM5 - Communications & Markets (S. 44)**
  - All practical Seminars offered at the IM can be chosen for Special Topics in Information Engineering & Management. Please update yourself on [www.ism.kit.edu/im/lehre](http://www.ism.kit.edu/im/lehre).
  - The module will be offered latest until SS 2014.
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 course “Communications Economics” will be offered latest until summer term 2014. The examination will be offered latest until winter term 2014/15 (repeaters only).

The course Portfolio and Asset Liability Management [2520357] will not be offered any more from summer term 2015 on. The examination will probably be offered latest until summer term 2014.

The course Stochastic Calculus and Finance [2521331] will not be offered any more from winter term 2014/2015 on. The examination will probably be offered latest until winter term 2013/14.

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).

The module [WW4INGBGU17] will not be offered any more from winter term 2014/15. It will be replaced by the module [WW4INGBGU22]. Students who are already assigned on the module [WW4INGBGU17] can still finish it until winter term 2015/16.

The module will be offered from winter term 2014/15.

The course “Scale up in Biology and Engineering [22417]” will not be offered anymore.
5 Modules

5.1 Economics

Module: Innovation and growth [TVWL4VWLIWW1]

Coordination: I. Ott

Degree programme: Technische Volkswirtschaftslehre (M.Sc.)

Subject: Economics

ECTS Credits 9  Cycle Every term  Duration 1

Courses in module

<table>
<thead>
<tr>
<th>ID</th>
<th>Course</th>
<th>Hours per week</th>
<th>Term</th>
<th>CP</th>
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<tr>
<td>2520543</td>
<td>Theory of Economic Growth</td>
<td>2/1</td>
<td>S</td>
<td>4,5</td>
<td>M. Hillebrand</td>
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<tr>
<td>2560236</td>
<td>Innovation theory and -policy</td>
<td>2/1</td>
<td>S</td>
<td>4,5</td>
<td>I. Ott</td>
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<tr>
<td>2561503</td>
<td>Theory of endogenous growth</td>
<td>2/1</td>
<td>W</td>
<td>4,5</td>
<td>I. Ott</td>
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Learning Control / Examinations

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

Conditions

None.

Recommendations

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

Learning Outcomes

Students shall be given the ability to

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

Content

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

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: Applied Strategic Decisions [TVWL4VWL2]

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

<table>
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<tr>
<th>ECTS Credits</th>
<th>Cycle</th>
<th>Duration</th>
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Courses in module

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<th>ID</th>
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<th>CP</th>
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<tr>
<td>2521533</td>
<td>Advanced Game Theory</td>
<td>2/1</td>
<td>W</td>
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<td>P. Reiss, C. Puppe, K. Ehrhart</td>
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<td>2590408</td>
<td>Auction Theory</td>
<td>2/1</td>
<td>W</td>
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<td>2540460</td>
<td>Market Engineering: Information in Institutions</td>
<td>2/1</td>
<td>S</td>
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<td>C. Weinhardt</td>
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<td>2540489</td>
<td>Experimental Economics</td>
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<td>W</td>
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<td>C. Weinhardt, T. Teubner</td>
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<tr>
<td>2520402/2520403</td>
<td>Predictive Mechanism and Market Design</td>
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<td>W</td>
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<td>2530214</td>
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<td>S</td>
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<td>2530232</td>
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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.

Learning Outcomes

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

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: Economic Policy II [TVWL4VWL3]

**Coordination:** J. Kowalski

**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)

**Subject:** Economics

<table>
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**Learning Control / Examinations**

The assessment is carried out as partial written exams (according to Section 4(2). 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The exams are offered at the beginning of the recess period about the subject matter of the latest held lecture. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately.

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

**Conditions**

None.

**Learning Outcomes**

**Content**

**Workload**

The total workload for this module is approximately 270 hours. For further information see German version.
Module: Network Economics [TVWL4VWL4]

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

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<td>2560234</td>
<td>Regulation Theory and Practice</td>
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<td>Transport Economics</td>
<td>2/1</td>
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<td>4,5</td>
<td>G. Liedtke, E. Szimba</td>
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<td>2561232</td>
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<td>Advanced Topics in Economic Theory</td>
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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 [26240] (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, principal agent theory, and contract theory.

Learning Outcomes
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 [TVWL4VWL5]

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

ECTS Credits 9
Cycle Every term
Duration 1

Courses in module

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<th>ID</th>
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<td>2560548</td>
<td>Environmental and Resource Policy</td>
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<td>S</td>
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<td>R. Walz</td>
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<td>2581003</td>
<td>Energy and Environment</td>
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<td>24140</td>
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<td>2560230</td>
<td>Transport Economics</td>
<td>2/1</td>
<td>S</td>
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<td>G. Liedtke, E. Szimba</td>
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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.

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

Learning Outcomes
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 [TVWL4VWL8]

Coordination: M. Hillebrand
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)
Subject: Economics

ECTS Credits: 9
Cycle: Every term
Duration: 2

Courses in module

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<th>ID</th>
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<td>M. Hillebrand</td>
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<tr>
<td>25549</td>
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<td>W</td>
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<td>M. Hillebrand</td>
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<td>2561503</td>
<td>Theory of endogenous growth</td>
<td>2/1</td>
<td>W</td>
<td>4.5</td>
<td>I. Ott</td>
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Learning Control / Examinations
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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.

Learning Outcomes
See German version.

Content

Workload
See German version.
Module: Telecommunications Markets [TVWL4VWL10]

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

ECTS Credits: 9  Cycle: Every term  Duration: 2

Courses in module

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Learning Control / Examinations
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Conditions
None.

Learning Outcomes
The module shall provide students with a general understanding of the economic correlations and structures of modern telecommunications markets. A broad overview over market structures, actors and relations of the different markets will be given and students shall acquire the means to analyze the interactions between different actors both qualitatively and by applying methods of industrial economics. On this basis students are able to examine practical issues from different perspectives and to assess the different practices.

Content
Accompanied by rapid technological developments the telecommunications markets have undergone substantial changes since their liberalization in the late 90s. Besides the former state-owned monopoly incumbents, a large number of new actors has established on different levels of the industry. While particularly on the service level, intensive competition has developed, some infrastructure elements still qualify as natural monopolies and are subject to regulation. With the rising number of actors, services and applications the economic correlations of these markets are getting more and more complex. Growing data volumes and technological developments give rise to new infrastructure investments. Actors have to consider direct and indirect network effects as they operate on several markets simultaneously and regulators need to keep the balance between fostering competition and incentivizing investments. The rapidly developing markets pose many issues that are worth to be discussed.

The two sector specific courses are complementary and address the most relevant aspects and economic effects that have influenced the development of telecommunications markets in the recent past and will most probably influence them in the future. For some topics the methods of industrial economics are applied, which makes the third course of the module, Industrial Organization, a perfect supplement to either of the two courses.

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

Remarks
The module will be offered latest until SS 2014.
Module: Transport infrastructure policy and regional development [TVWL4VWL11]

Cooperation: K. Mitusch  
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)  
Subject: Economics

<table>
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Courses in module

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<tr>
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<td>S</td>
<td>4,5</td>
<td>G. Liedtke, E. Szimba</td>
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<td>Spatial Economics</td>
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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.

Learning Outcomes
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 [TWVL4VWL12]

**Coordination:** I. Ott

**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)

**Subject:** Economics

**ECTS Credits**

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**Courses in module**

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<td>I. Ott</td>
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<td>Spatial Economics</td>
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<td>2560254</td>
<td>International Economic Policy</td>
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**Learning Control / Examinations**

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

**Conditions**

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

**Recommendations**

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

**Learning Outcomes**

The student

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

**Content**

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

**Workload**

The total workload for this module is approximately 270 hours. For further information see German version.
Module: Agglomeration and Innovation [TVWL4VWL13]

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

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Courses in module

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<td>M. Hillebrand, K. Mitusch</td>
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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.

Learning Outcomes
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 [TVWL4VWL14]

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

ECTS Credits: 9
Cycle: Every term
Duration: 1

Courses in module

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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.

Learning Outcomes
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 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 [TVWL4VWL15]

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

ECTS Credits
Cycle
Duration

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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.

Learning Outcomes
For the objective of the module see the description of the courses.

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.
Module: Collective Decision Making [TVWL4VWL16]

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

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Learning Control / Examinations
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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.

Learning Outcomes
For the objective of the module see the description of the courses.

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 [TVWL4VWL17]

**Coordination:** P. Reiss
**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)
**Subject:** Economics

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**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.

**Learning Outcomes**
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: Advanced Topics in Public Finance [TVWL4VWL18]

Coordination: B. Wigger
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)
Subject: Economics

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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.

Learning Outcomes
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
The module will be offered from winter term 2014/15.
5.2 Business Administration

Module: Finance 1 [TVWL4BWLFBV1]

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

ECTS Credits
Cycle
Duration

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

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

Conditions
None.

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

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

Workload
See German version.
Module: Finance 2 [TVWL4BWLFBV2]

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

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<td>2/1</td>
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Learning Control / Examinations
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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 [TVWL4BWLFBV1]. The module is passed only after the final partial exam of Finance 1 is additionally passed.

Learning Outcomes
The student has advanced skills in economics and methodology in the field of modern finance.

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

Workload
See German version.

Remarks
Only in the winter term 2011/2012 the lecture Market Microstructure [2530240] could be replaced by the lecture eFinance: Information Engineering and Management for Securities Trading [2540454] within the corresponding module. Who wanted to replace it in this way had to make the first attempt at passing the examination at the regular examination dates of this winter term 2011/2012. The general regulation concerning the second attempt at passing the examination remains unchanged. The lecture eFinance: Information Engineering and Management for Securities Trading [2540454] must not be chosen in all other cases within this module.
Module: Finance 3 [TVWL4BWLFBV11]

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

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<td>2530299</td>
<td>Business Strategies of Banks</td>
<td>2</td>
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<td>2530570</td>
<td>International Finance</td>
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<td>M. Uhrig-Homburg, Dr. Walter</td>
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<tr>
<td>2540454</td>
<td>eFinance: Information Engineering and Management for Securities Trading</td>
<td>2/1</td>
<td>W</td>
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<td>C. Weinhardt</td>
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Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately. The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
It is only possible to choose this module in combination with the module Finance 1 [TVWL4BWLFBV1] and Finance 2 [TVWL4BWLFBV2]. The module is passed only after the final partial exams of Finance 1 and Finance 2 are additionally passed.

Learning Outcomes
The student has advanced skills in economics and methodology in the field of finance.

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

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

Remarks
Only in the winter term 2011/2012 the lecture Market Microstructure [2530240] could be replaced by the lecture eFinance: Information Engineering and Management for Securities Trading [2540454] within the corresponding module. Who wanted to replace it in this way had to make the first attempt at passing the examination at the regular examination dates of this winter term 2011/2012. The general regulation concerning the second attempt at passing the examination remains unchanged. The lecture eFinance: Information Engineering and Management for Securities Trading [2540454] must not be chosen in all other cases within this module.
Module: Computational Finance [TVWL4BWLFBV12]

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

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Courses in module

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<tr>
<td>2530371</td>
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</table>

Learning Control / Examinations
The assessment is carried out as a combination of one module-wide 180 minutes written exam (Paragraph 4 (2) Nr 1 of the exam regulation) at the end of the course and several additional performance reviews according to Paragraph 4 (2) Nr. 3. The overall grade of the module is the weighted average of the module-wide written exam and the additional performance reviews. The former has a weight of 60%, whereas the latter counts for 40%. To improve the overall grade students can ask for a special project.

Conditions
None.

Recommendations
There are no formal prerequisites for this course. Nevertheless, having heard Investments (Module Essentials of Finance) and Optimization will facilitate the transition into the Computational Finance Module.

Learning Outcomes
The objective of this module is to become familiar with empirical and numerical algorithms necessary for quantitative asset and risk management.

The students will learn how to empirically estimate the return characteristics of assets (expected return, volatility, and cross-correlations) using simulated and real-world data and apply them to the strategic portfolio allocation concept of Markowitz.

Also they are capable to understand the intuition and algorithm behind empirical methods and obtain an understanding and working knowledge of important numerical concepts.

Content
Markowitz portfolio optimization (empirical and numerical implementation)
Generating random numbers
Techniques for Monte Carlo Simulations
Time-Series methods (ARMA, predictions, impulse response functions, Wold decomposition, VAR, Granger causality, unit roots, cointegration)
Maximum-Likelihood and Kalman Filtering
CAPM, Fama/French and Fama/MacBeth regressions to estimate risk premia (i.e. expected returns on investment)
numerical root finding
numerical optimization
numerical integration of ode's, pde's, and sde's
analytical solution to simple ode's and sde's

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

Remarks
The module will be offered from winter term 2014/15.
The course of the module is held in English.
Module: Insurance Management I [TVWL4BWLFBV6]

**Coordination:** U. Werner  
**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)  
**Subject:** Business Administration

### Courses in module

<table>
<thead>
<tr>
<th>ID</th>
<th>Course</th>
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<th>Term</th>
<th>CP</th>
<th>Responsible Lecturer(s)</th>
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<tr>
<td>2550055</td>
<td>Principles of Insurance Management</td>
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<td>S</td>
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<td>U. Werner</td>
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<tr>
<td>2530323</td>
<td>Insurance Marketing</td>
<td>3/0</td>
<td>S</td>
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<tr>
<td>2530324</td>
<td>Insurance Production</td>
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<tr>
<td>2530050</td>
<td>Private and Social Insurance</td>
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<td>W</td>
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<td>W. Heilmann, K. Besserer</td>
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<tr>
<td>2530350</td>
<td>Current Issues in the Insurance Industry</td>
<td>2/0</td>
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<td>INSGAME</td>
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<td>W/S</td>
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<td>2530355</td>
<td>Modelling, Measuring and Managing of Extreme Risks</td>
<td>2</td>
<td>S</td>
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<td>U. Werner, S. Hochrainer</td>
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**Learning Control / Examinations**

The assessment is carried out as partial exams (according to Section 4(2) of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

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

**Conditions**

None.

**Learning Outcomes**

See German version.

**Content**

See German version.

**Workload**

See German version.
Module: Insurance Management II [TVWL4BWLFBV7]

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

<table>
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<th>ID</th>
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<td>Current Issues in the Insurance Industry</td>
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<td>S</td>
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<tr>
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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.

Learning Outcomes
See German version.

Content
See German version.

Workload
See German version.

Remarks
See German version.
Module: Strategic Corporate Management and Organization [TVWL4BWLUO1]

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

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Courses in module

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<td>2577904</td>
<td>Organization Theory</td>
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<td>W</td>
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<td>2577902</td>
<td>Managing Organizations</td>
<td>2/0</td>
<td>W</td>
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<td>2577908</td>
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<td>2</td>
<td>S</td>
<td>4.5</td>
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<tr>
<td>2577900</td>
<td>Management and Strategy</td>
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<td>S</td>
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<td>2577910</td>
<td>Problem solving, communication and leadership</td>
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Learning Control / Examinations
The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The examinations are offered every semester. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately.

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

Conditions
None.

Learning Outcomes
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
See German version.

Remarks
The course “Organization Theory” will not be offered in winter term 2014/15.
Module: Strategic Decision Making and Organization  [TVWL4BWLKO3]

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

ECTS Credits 9
Cycle Every term
Duration 1

Courses in module

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<td>2561127</td>
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<td>B. Wigger, Assistenten</td>
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<td>2572157</td>
<td>Pricing</td>
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Learning Control / Examinations
The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The examinations are offered every semester. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately.

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

Conditions
None.

Learning Outcomes
See German version.

Content

Workload
See German version.

Remarks
The course “Organization Theory” will not be offered in winter term 2014/15.
Module: Management Accounting [TVWL4BWLIBU1]

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

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Courses in module

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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.

Learning Outcomes
Students have knowledge about various management accounting techniques through study of literature and practice.

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 [TVWL4BWLIBU2]

**Coordination:** M. Wouters  
**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)  
**Subject:** Business Administration

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#### Courses in module

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<th>CP</th>
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<tr>
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<td>W</td>
<td>4,5</td>
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<td>2571154</td>
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<td>2571176</td>
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<td>2530212</td>
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<td>2577908</td>
<td>Modeling Strategic Decision Making</td>
<td>2</td>
<td>S</td>
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#### 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.

#### Learning Outcomes

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.

#### Remarks

The module will be offered from winter term 2014/15.
Module: Advanced CRM [TVWL4BWLISM1]

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

<table>
<thead>
<tr>
<th>ID</th>
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<td>2540506</td>
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<tr>
<td>2540533</td>
<td>Personalization and Services</td>
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<td>S</td>
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<td>2540518</td>
<td>Social Network Analysis in CRM</td>
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<td>S</td>
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**Learning Control / Examinations**

The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

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

**Conditions**

None.

**Learning Outcomes**

The student

- 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 calculation 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**

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 [TVWL4BWLSM2]

**Coordinations:** A. Geyer-Schulz

**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)

**Subject:** Business Administration

**ECTS Credits**

<table>
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<td>W</td>
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<td>A. Geyer-Schulz</td>
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<tr>
<td>2540460</td>
<td>Market Engineering: Information in Institutions</td>
<td>2/1</td>
<td>S</td>
<td>4.5</td>
<td>C. Weinhardt</td>
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<tr>
<td>2561232</td>
<td>Telecommunication and Internet Economics</td>
<td>2/1</td>
<td>W</td>
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<td>K. Mitusch</td>
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<td>2540531</td>
<td>Business Dynamics</td>
<td>2/1</td>
<td>S</td>
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<td>A. Geyer-Schulz, P. Glenn</td>
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<td>2540500</td>
<td>Business Administration in Information Engineering and Management</td>
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**Learning Control / Examinations**

The assessment is carried out as partial exams (according to Section 4(2) of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

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

**Conditions**

None.

**Learning Outcomes**

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 analyze 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 like bounded rationality and information asymmetries (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**

- 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**
See German version.

**Remarks**
The course *Electronic Marktes: Principles* is not offered at the moment. The last exam takes place at the end of summer term 14.
Module: Market Engineering [TVWL4BWLISM3]

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

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Courses in module

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<th>Term</th>
<th>CP</th>
<th>Responsible Lecturer(s)</th>
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<td>Market Engineering: Information in Institutions</td>
<td>2/1 S</td>
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<td>C. Weinhardt</td>
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<tr>
<td>2590408</td>
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<td>2/1 W</td>
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<td>K. Ehrhart</td>
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<tr>
<td>2540454</td>
<td>eFinance: Information Engineering and Management for Securities Trading</td>
<td>2/1 W</td>
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<td>2590458</td>
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<td>2/1 W</td>
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<td>P. Shukla, S. Caton</td>
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<tr>
<td>2540489</td>
<td>Experimental Economics</td>
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<td>2540464</td>
<td>eEnergy: Markets, Services, Systems</td>
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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.

Learning Outcomes
The students

- know the design criteria 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 of markets and their success. Markets are complex interactions of different institutions and participants in a market that 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
See German version.
Module: Business & Service Engineering [TVWL4BWLISM4]

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

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Courses in module

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<tr>
<td>2540456</td>
<td>Business Models in the Internet: Planning and Implementation</td>
<td>2/1</td>
<td>S</td>
<td>4.5</td>
<td>T. Teubner, R. Knapper</td>
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<tr>
<td>2540498</td>
<td>Special Topics in Information Engineering &amp; Management</td>
<td>3</td>
<td>W/S</td>
<td>4.5</td>
<td>C. Weinhardt</td>
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<tr>
<td>2540506</td>
<td>Recommender Systems</td>
<td>2/1</td>
<td>S</td>
<td>4.5</td>
<td>A. Geyer-Schulz, A. Sonnenbichler</td>
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<tr>
<td>2540533</td>
<td>Personalization and Services</td>
<td>2/1</td>
<td>S</td>
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<td>A. Sonnenbichler</td>
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<tr>
<td>2595468</td>
<td>Service Innovation</td>
<td>2/1</td>
<td>S</td>
<td>4.5</td>
<td>G. Satzger, M. Kohler, N. Feldmann</td>
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<td>2595477</td>
<td>Practical Seminar Service Innovation</td>
<td>3</td>
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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.

Learning Outcomes
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
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: Communications & Markets [TVWL4BWLISM5]

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

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Courses in module

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<th>Responsible Lecturer(s)</th>
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<tr>
<td>2540462</td>
<td>Communications Economics</td>
<td>2/1</td>
<td>S</td>
<td>4.5</td>
<td>J. Kraemer</td>
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<tr>
<td>2540460</td>
<td>Market Engineering: Information in Institutions</td>
<td>2/1</td>
<td>S</td>
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<td>C. Weinhardt</td>
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<tr>
<td>2590408</td>
<td>Auction Theory</td>
<td>2/1</td>
<td>W</td>
<td>4.5</td>
<td>K. Ehrhart</td>
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<tr>
<td>2540498</td>
<td>Special Topics in Information Engineering &amp; Management</td>
<td>3</td>
<td>W/S</td>
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<td>C. Weinhardt</td>
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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 Communications Economics [2540462] is compulsory and must be examined.

Learning Outcomes
The student is able to

- understand the game theoretic basics of Industrial Economics
- understand the relationship between incentive mechanisms and the network economy
- analyse and evaluate markets and auction mechanisms using methods from game theory
- elaborate solutions in a team

Content
The module has a focus on applied game-theoretic analysis of information exchange and incentive mechanisms. Single participants in a market make decisions concerning their products, the price determination and competitive position, which can change the situation in a market. These changes inflict a change in corporate policy. Approaches from game-theory in industrial economics and mechanism design are offering analytic tools by which one can systematically deduce strategic decisions for businesses, given a certain market situation.

Workload
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 module will be offered latest until SS 2014.
Module: Service Management [TVWL4BWLISM6]

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

<table>
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Courses in module

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<th>CP</th>
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<td>2595484</td>
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<td>2/1 W</td>
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<tr>
<td>2595468</td>
<td>Service Innovation</td>
<td>2/1 S</td>
<td>4,5</td>
<td>G. Satzger, M. Kohler, N. Feldmann</td>
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<tr>
<td>2595501</td>
<td>Service Analytics</td>
<td>2/1 S</td>
<td>4,5</td>
<td>T. Setzer, H. Fromm</td>
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<tr>
<td>2595505</td>
<td>Industrial Services</td>
<td>2/1 W</td>
<td>4,5</td>
<td>H. Fromm</td>
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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.

Learning Outcomes

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.

Remarks

In the summer term 2012, the lectures eServices and Management of Business Networks were taken out of this module. They will be continued to be offered exclusively in the Bachelor modules. Modules correctly opened before the summer term, are not affected by this change.
Module: Information Engineering [TVWL4BWLISM7]

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

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Courses in module

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<tr>
<td>2540450</td>
<td>Principles of Information Engineering and Management</td>
<td>2/1</td>
<td>W</td>
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<td>C. Weinhardt, T. Teubner</td>
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<td>2540462</td>
<td>Communications Economics</td>
<td>2/1</td>
<td>S</td>
<td>4.5</td>
<td>J. Kraemer</td>
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<td>Market Engineering: Information in Institutions</td>
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<td>S</td>
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<td>C. Weinhardt</td>
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<td>2540498</td>
<td>Special Topics in Information Engineering &amp; Management</td>
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<td>W/S</td>
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<td>C. Weinhardt</td>
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<tr>
<td>2540464</td>
<td>eEnergy: Markets, Services, Systems</td>
<td>2/1</td>
<td>S</td>
<td>4.5</td>
<td>C. Weinhardt</td>
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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.

Learning Outcomes
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 chosen, 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. The course “Communications Economics” will be offered latest until summer term 2014. The examination will be offered latest until winter term 2014/15 (repeaters only).
Module: Service Analytics [TVWL4BWLKSR1]

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

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Courses in module

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<th>CP</th>
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<tr>
<td>2595501</td>
<td>Service Analytics</td>
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<td>T. Setzer, H. Fromm</td>
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<td>Industrial Services</td>
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<td>W/S</td>
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<td>C. Weinhardt</td>
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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.

Learning Outcomes
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.
Module: Industrial Production II [TVWL4BWLIIP2]

**Coordination:** F. Schultmann

**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)

**Subject:** Business Administration

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<tr>
<td>2581952</td>
<td>Planning and Management of Industrial Plants</td>
<td>2/2</td>
<td>W</td>
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<tr>
<td>2581962</td>
<td>Emissions into the Environment</td>
<td>2/0</td>
<td>W</td>
<td>3.5</td>
<td>U. Karl</td>
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<td>2581995</td>
<td>Material Flow Analysis and Life Cycle Assessment</td>
<td>2/0</td>
<td>W</td>
<td>3.5</td>
<td>L. Schebek</td>
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<tr>
<td>2581956</td>
<td>International Management in Engineering and Production</td>
<td>2/0</td>
<td>W</td>
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<td>H. Sasse</td>
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**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” [TVWL4BWLIIP6] (Master).

**Learning Outcomes**

- 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
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 [TVWL4BWLIIP6]

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

<table>
<thead>
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Courses in module

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<th>CP</th>
<th>Responsible Lecturer(s)</th>
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<tr>
<td>2581954</td>
<td>Production and Logistics Management</td>
<td>2/2</td>
<td>S</td>
<td>5,5</td>
<td>M. Fröhling</td>
</tr>
<tr>
<td>2581963</td>
<td>The Management of R&amp;D Projects with Case Studies</td>
<td>2</td>
<td>W/S</td>
<td>3,5</td>
<td>H. Schmied</td>
</tr>
<tr>
<td>2581961</td>
<td>Supply Chain Management with Advanced Planning Systems</td>
<td>2</td>
<td>S</td>
<td>3,5</td>
<td>M. Göbelt, C. Sürie</td>
</tr>
<tr>
<td>2581992</td>
<td>Risk Management in Industrial Supply Networks</td>
<td>2/0</td>
<td>W</td>
<td>3,5</td>
<td>M. Wiens</td>
</tr>
<tr>
<td>2581957</td>
<td>Supply Chain Management in the automotive industry</td>
<td>2/0</td>
<td>W</td>
<td>3,5</td>
<td>T. Heupel, H. Lang</td>
</tr>
</tbody>
</table>

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.

Learning Outcomes

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

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

ECTS Credits: 9
Cycle: Every term
Duration: 1

Courses in module

<table>
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<tr>
<th>ID</th>
<th>Course</th>
<th>Hours per week</th>
<th>Term</th>
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<tr>
<td>2581998</td>
<td>Basics of Liberalised Energy Markets</td>
<td>2/1</td>
<td>W</td>
<td>3.5</td>
<td>W. Fichtner</td>
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<tr>
<td>2581020</td>
<td>Energy Trade and Risk Management</td>
<td>2/1</td>
<td>S</td>
<td>3.5</td>
<td>K. Hufendiek</td>
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<tr>
<td>2581959</td>
<td>Energy Policy</td>
<td>2/0</td>
<td>S</td>
<td>3.5</td>
<td>M. Wietschel</td>
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<td>2581022</td>
<td>Gas-Markets</td>
<td>2/0</td>
<td>W</td>
<td>3</td>
<td>A. Pustisek</td>
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<tr>
<td>2581025</td>
<td>Simulation Game in Energy Economics</td>
<td>2/0</td>
<td>S</td>
<td>3</td>
<td>W. Fichtner</td>
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<tr>
<td>2560234</td>
<td>Regulation Theory and Practice</td>
<td>2/1</td>
<td>S</td>
<td>4.5</td>
<td>K. Mitusch</td>
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<tr>
<td>2540464</td>
<td>eEnergy: Markets, Services, Systems</td>
<td>2/1</td>
<td>S</td>
<td>4.5</td>
<td>C. Weinhardt</td>
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<td>2581007</td>
<td>Quantitative Methods in Energy Economics</td>
<td>2/1</td>
<td>W</td>
<td>4</td>
<td>D. Keles, P. Plötz</td>
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Learning Control / Examinations
The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The examinations take place every semester. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal. Additional courses might be accredited upon request.

Conditions
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.

Learning Outcomes
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
See German version.
Module: Energy Economics and Technology [TVWL4BWLIIP5]

**Coordination:** W. Fichtner  
**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)  
**Subject:** Business Administration

<table>
<thead>
<tr>
<th>Courses in module</th>
<th>Hours per week</th>
<th>Term</th>
<th>CP</th>
<th>Responsible Lecturer(s)</th>
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<td>ID 2581003 Energy and Environment</td>
<td>2/1</td>
<td>S</td>
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<td>U. Karl, n.n.</td>
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<tr>
<td>ID 2581958 Strategic Aspects of Energy Economy</td>
<td>2/0</td>
<td>W</td>
<td>3.5</td>
<td>A. Ardone</td>
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<tr>
<td>ID 2581000 Technological Change in Energy Economics</td>
<td>2/0</td>
<td>W</td>
<td>3</td>
<td>M. Wietschel</td>
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<td>ID 2581001 Heat Economy</td>
<td>2/0</td>
<td>S</td>
<td>3</td>
<td>W. Fichtner</td>
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<tr>
<td>ID 2581002 Energy Systems Analysis</td>
<td>2/0</td>
<td>W</td>
<td>3</td>
<td>V. Bertsch</td>
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<tr>
<td>ID 2581006 Efficient Energy Systems and Electric Mobility</td>
<td>2/0</td>
<td>S</td>
<td>3.5</td>
<td>R. McKenna, P. Jochem</td>
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</table>

**Learning Control / Examinations**  
The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The examinations take place every semester. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal. Additional courses might be accredited upon request.

**Conditions**  
None.

**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.

**Learning Outcomes**  
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**  
See German version.
Module: Marketing Management [TVWL4BWLMAR5]

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

<table>
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**Courses in module**

<table>
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<tr>
<th>ID</th>
<th>Course</th>
<th>Hours per week</th>
<th>Term</th>
<th>CP</th>
<th>Responsible Lecturer(s)</th>
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<tbody>
<tr>
<td>2571154</td>
<td>Product and Innovation Marketing</td>
<td>2/0</td>
<td>S</td>
<td>3</td>
<td>M. Klarmann</td>
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<tr>
<td>2571150</td>
<td>Market Research</td>
<td>2/1</td>
<td>S</td>
<td>4.5</td>
<td>M. Klarmann</td>
</tr>
<tr>
<td>2572167</td>
<td>Behavioral Approaches in Marketing</td>
<td>2/1</td>
<td>W</td>
<td>4.5</td>
<td>B. Neibecker</td>
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<tr>
<td>2571165</td>
<td>Strategic and Innovative Decision Making in Marketing</td>
<td>2/1</td>
<td>S</td>
<td>4.5</td>
<td>B. Neibecker</td>
</tr>
<tr>
<td>2572184</td>
<td>Business Plan Workshop</td>
<td>1</td>
<td>S</td>
<td>3</td>
<td>M. Klarmann, O. Terzidis</td>
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<tr>
<td>2571176</td>
<td>Marketing Strategy Business Game</td>
<td>1</td>
<td>S</td>
<td>1.5</td>
<td>M. Klarmann, Mitarbeiter</td>
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<tr>
<td>2571185</td>
<td>Strategic Brand Management</td>
<td>1/0</td>
<td>S</td>
<td>1.5</td>
<td>M. Klarmann, J. Blickhäuser</td>
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</table>

**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 or Strategic Brand Management.

**Learning Outcomes**

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**

For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).
Module: Sales Management [TVWL4BWLMAR6]

Coordination: M. Klarmann, M. Artz
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)
Subject: Business Administration

<table>
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<th>ECTS Credits</th>
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Courses in module

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<th>Course</th>
<th>Hours per week</th>
<th>Term</th>
<th>CP</th>
<th>Responsible Lecturer(s)</th>
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<tr>
<td>2572156</td>
<td>Sales Management and Retailing</td>
<td>2</td>
<td>W</td>
<td>3</td>
<td>M. Klarmann</td>
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<tr>
<td>2572157</td>
<td>Pricing</td>
<td>2/1</td>
<td>W</td>
<td>4,5</td>
<td>M. Klarmann</td>
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<tr>
<td>2571150</td>
<td>Market Research</td>
<td>2/1</td>
<td>S</td>
<td>4,5</td>
<td>M. Klarmann</td>
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<tr>
<td>2572182</td>
<td>Case Studies in Pricing</td>
<td>1</td>
<td>W</td>
<td>1,5</td>
<td>M. Klarmann, Mitarbeiter</td>
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<tr>
<td>2572198</td>
<td>Price Negotiation and Sales Presentations</td>
<td>1</td>
<td>W</td>
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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.

Learning Outcomes

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 [TVWL4BWLMAR7]

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

<table>
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<th>Cycle</th>
<th>Duration</th>
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### Courses in module

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<th>ID</th>
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<th>Term</th>
<th>CP</th>
<th>Responsible Lecturer(s)</th>
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<tr>
<td>2572167</td>
<td>Behavioral Approaches in Marketing</td>
<td>2/1</td>
<td>W</td>
<td>4,5</td>
<td>B. Neibecker</td>
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<tr>
<td>2571165</td>
<td>Strategic and Innovative Decision Making in Marketing</td>
<td>2/1</td>
<td>S</td>
<td>4,5</td>
<td>B. Neibecker</td>
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<tr>
<td>2571162</td>
<td>Information Technology and Business Information</td>
<td>2/1</td>
<td>S</td>
<td>4,5</td>
<td>B. Neibecker</td>
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<td>2572157</td>
<td>Pricing</td>
<td>2/1</td>
<td>W</td>
<td>4,5</td>
<td>M. Klarmann</td>
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### 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.

### Learning Outcomes
Beyond the learning outcomes given with the individual courses the module open the possibility for a systematic consolidation in marketing.

### 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: Entrepreneurship (EnTechnon) [TVWL4BWLENT1]

**Coordination:** O. Terzidis, A. Presse
**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)
**Subject:** Business Administration

<table>
<thead>
<tr>
<th>ID</th>
<th>Course</th>
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<tr>
<td>2545001</td>
<td>Entrepreneurship</td>
<td>2 W/S 3</td>
<td>O. Terzidis</td>
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<td>2545010</td>
<td>Design Thinking</td>
<td>2 W/S 3</td>
<td>O. Terzidis, Dr. Kneisel, Dr. H. Haller, P. Nitschke</td>
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<tr>
<td>2545005</td>
<td>Business Planning</td>
<td>2 W/S 3</td>
<td>O. Terzidis, Mitarbeiter des Lehrstuhls</td>
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<td>2545012</td>
<td>Entrepreneurial Leadership &amp; Innovation Management</td>
<td>2 W 3</td>
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<td>2545003</td>
<td>Managing New Technologies</td>
<td>2/1 S 5</td>
<td>T. Reiß</td>
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<td>2572184</td>
<td>Business Plan Workshop</td>
<td>1 S 3</td>
<td>M. Klarmann, O. Terzidis</td>
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<tr>
<td>2545015</td>
<td>Innovation Management: Concepts, Strategies and Methods</td>
<td>2 S 3</td>
<td>M. Weissenberger-Eibl</td>
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<tr>
<td>2540456</td>
<td>Business Models in the Internet: Planning and Implementation</td>
<td>2/1 S 4,5</td>
<td>T. Teubner, R. Knapper</td>
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<tr>
<td>2513305</td>
<td>Developing Business Models for the Semantic Web</td>
<td>2 W 3</td>
<td>R. Studer, M. Maleshkova, F. Keppmann</td>
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<tr>
<td>2545019</td>
<td>Case studies seminar: Innovation management</td>
<td>2 W 3</td>
<td>M. Weissenberger-Eibl</td>
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<td>2545016</td>
<td>Roadmapping</td>
<td>2 S 3</td>
<td>D. Koch</td>
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<td>n.n.</td>
<td>Entrepreneurship Research</td>
<td>2 S 3</td>
<td>O. Terzidis, Mitarbeiter</td>
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</table>

Learning Control / Examinations
See German version.

Conditions
None.

Learning Outcomes
See German version.

Content

Workload
The total workload for this module is approximately 270 hours. For further information see German version.
Module: Innovation Management [TVWL4BWLENT2]

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

<table>
<thead>
<tr>
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<tr>
<td>2545015 Innovation Management: Concepts, Strategies and Methods</td>
<td>2</td>
<td>S</td>
<td>3</td>
<td>M. Weissenberger-Eibl</td>
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<tr>
<td>2545016 Roadmapping</td>
<td>2</td>
<td>S</td>
<td>3</td>
<td>D. Koch</td>
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<tr>
<td>2545017 Technology Assessment</td>
<td>2</td>
<td>S</td>
<td>3</td>
<td>D. Koch</td>
</tr>
<tr>
<td>2545018 Technologies for Innovation Management</td>
<td>2</td>
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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.

Learning Outcomes
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: Real Estate Economics and Sustainability [TVWL4BWLÖÖW1]

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

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Courses in module

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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

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;
• 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.
5.3 Informatics

Module: Informatics [TVWL4INFO1]

**Coordination:** H. Schmeck, A. Oberweis, D. Seese, R. Studer
**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)
**Subject:** Informatics

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

Conditions
One course has to be chosen from the core courses.
Core courses are: Algorithms for Internet Applications [2511102], Applied Informatics I - Modelling [2511030], Applied Informatics II - IT Systems for e-Commerce [2511032], Complexity Management [2511400], Database Systems [2511200], Service-oriented Computing I [2511500] and Knowledge Management [2511300].

It is only allowed to choose one lab.

Learning Outcomes
The student

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

Content
The thematic focus will be based on the choice of courses in the areas of Effiziente Algorithmen, Betriebliche Informations- und Kommunikationssysteme, Wissensmanagement, Komplexitätsmanagement 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 [TVWL4INFO2]

**Coordination:** H. Schmeck, A. Oberweis, D. Seese, R. Studer  
**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)  
**Subject:** Informatics

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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
One course has to be chosen from the core courses.
Core courses are: Algorithms for Internet Applications [2511102], Applied Informatics I - Modelling [2511030], Applied Informatics II - IT Systems for e-Commerce [2511032], Complexity Management [2511400], Database Systems [2511200], Service-oriented Computing I [2511500] and Knowledge Management [2511300].
It is only allowed to choose one lab.

Learning Outcomes
The student
- has the ability to master methods and tools in a complex discipline and to demonstrate 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 [TVWL4INFO3]

**Coordination:** H. Schmeck, A. Oberweis, D. Seese, R. Studer

**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)

**Subject:** Informatics

<table>
<thead>
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<td>2511212</td>
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Learning Control / Examinations
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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 single 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
None.

Learning Outcomes
The student

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

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

Workload
See German version.
5.4 Operations Research


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

<table>
<thead>
<tr>
<th>ID</th>
<th>Course</th>
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<th>CP</th>
<th>Responsible Lecturer(s)</th>
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<td>Discrete-event Simulation in Production and Logistics</td>
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<td>Supply Chain Management in the Process Industry</td>
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<td>Challenges in Supply Chain Management</td>
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Learning Control / Examinations
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Conditions
See German version.

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

Learning Outcomes
The student

- is familiar with basic concepts and terms of Supply Chain Management,
- knows the different areas of SCM and their respective optimization problems,
- is acquainted with classical location problem models (in planes, in networks and discrete) as well as fundamental methods for distribution and transport planning, inventory planning and management,
- is familiar with general procedures and characteristics of Health Care Management and the possibilities for adapting mathematical models for non-profit organizations,
- is able to model practical problems mathematically and estimate their complexity as well as choose and adapt appropriate solution methods.
Content
Supply Chain Management is concerned with the planning and optimization of the entire, inter-company procurement, production and distribution process for several products taking place between different business partners (suppliers, logistics service providers, dealers). The main goal is to minimize the overall costs while taking into account several constraints including the satisfaction of customer demands.

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

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

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 [TVWL4OR6]

**Coordination:** O. Stein

**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)

**Subject:** Operations Research

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**Courses in module**

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**Learning Control / Examinations**

The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

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

**Conditions**

See German version.

**Learning Outcomes**

The student

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

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 [TVWL4OR7]

**Coordination:** K. Waldmann  
**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)  
**Subject:** Operations Research

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### Courses in module

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<td>25688</td>
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<td>W/S</td>
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<td>K. Waldmann</td>
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### Learning Control / Examinations

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

### Conditions

See German version.

### Learning Outcomes

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

### Content

**Topics overview:**

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 [TVWL4STAT1]

Coordination: W. Heller
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)
Subject: Statistics

ECTS Credits 9
Cycle Irregular
Duration 1

Courses in module

<table>
<thead>
<tr>
<th>ID</th>
<th>Course</th>
<th>Hours per week C/E/T</th>
<th>Term</th>
<th>CP</th>
<th>Responsible Lecturer(s)</th>
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<tbody>
<tr>
<td>2520357/2520358</td>
<td>Portfolio and Asset Liability Management</td>
<td>2/1</td>
<td>S</td>
<td>5</td>
<td>W. Heller</td>
</tr>
<tr>
<td>2521331</td>
<td>Stochastic Calculus and Finance</td>
<td>2/1</td>
<td>W</td>
<td>4.5</td>
<td>W. Heller</td>
</tr>
<tr>
<td>2520381</td>
<td>Advanced Econometrics of Financial Markets</td>
<td>2/1</td>
<td>S</td>
<td>5</td>
<td>A. Nazemi</td>
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Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
None.

Learning Outcomes
See German version.

Content

Workload
See German version.

Remarks
The course Portfolio and Asset Liability Management [2520357] will not be offered any more from summer term 2015 on. The examination will probably be offered latest until summer term 2014.
The course Stochastic Calculus and Finance [2521331] will not be offered any more from winter term 2014/2015 on. The examination will probably be offered latest until winter term 2013/14.
Module: Statistical Methods in Risk Management [TVWL4STAT2]

Coordination: W. Heller
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)
Subject: Statistics

ECTS Credits: 9
Cycle: Every term
Duration: 1

Courses in module

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<td>Stochastic and Econometric Models in Credit Risk Management</td>
<td>2/2</td>
<td>S</td>
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<td>Y. Kim</td>
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<tr>
<td>2520375</td>
<td>Data Mining</td>
<td>2</td>
<td>W/S</td>
<td>5</td>
<td>G. Nakhaeizadeh</td>
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<tr>
<td>2520317</td>
<td>Multivariate Methods</td>
<td>2/2</td>
<td>S</td>
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<tr>
<td>2521353</td>
<td>Statistical Methods in Financial Risk Management</td>
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<tr>
<td>2521325/2521326</td>
<td>Statistics and Econometrics in Business and Economics</td>
<td>2/2</td>
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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 separetely.
The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Conditions
None.

Learning Outcomes
See German version.

Content
Workload
See German version.
### 5.6 Engineering Sciences

**Module: Introduction to Logistics [TVWL4INGMB20]**

**Coordination:** K. Furmans  
**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)  
**Subject:** Engineering Science

<table>
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**Courses in module**

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<th>CP</th>
<th>Responsible Lecturer(s)</th>
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<tbody>
<tr>
<td>2117051</td>
<td>Material flow in logistic systems</td>
<td>3/1</td>
<td>W</td>
<td>6</td>
<td>K. Furmans</td>
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<tr>
<td>2118183</td>
<td>IT-Fundamentals of Logistics</td>
<td>2</td>
<td>S</td>
<td>4</td>
<td>F. Thomas</td>
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<tr>
<td>2118097</td>
<td>Warehousing and distribution systems</td>
<td>2</td>
<td>S</td>
<td>4</td>
<td>M. Schwab, J. Weiblen</td>
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<tr>
<td>2117056</td>
<td>Airport logistics</td>
<td>2</td>
<td>W</td>
<td>4</td>
<td>A. Richter</td>
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<tr>
<td>2117061</td>
<td>Safety Engineering</td>
<td>2</td>
<td>W</td>
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<td>H. Kany</td>
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<tr>
<td>2117064</td>
<td>Application of technical logistics in modern crane systems</td>
<td>2</td>
<td>W</td>
<td>4</td>
<td>M. Golder</td>
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<tr>
<td>2118089</td>
<td>Application of technical logistics in sorting- and distribution technology</td>
<td>2</td>
<td>S</td>
<td>4</td>
<td>J. Föller</td>
</tr>
<tr>
<td>2118085</td>
<td>Automotive Logistics</td>
<td>2</td>
<td>S</td>
<td>4</td>
<td>K. Furmans</td>
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<tr>
<td>2118094</td>
<td>Information Systems in Logistics and Supply Chain Management</td>
<td>2</td>
<td>S</td>
<td>4</td>
<td>C. Kilger</td>
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<tr>
<td>2117500</td>
<td>Energy efficient intralogistic systems</td>
<td>2</td>
<td>W</td>
<td>4</td>
<td>F. Schöning</td>
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<tr>
<td>2117095</td>
<td>Basics of Technical Logistics</td>
<td>3/1</td>
<td>W</td>
<td>6</td>
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<tr>
<td>2117096</td>
<td>Elements of Technical Logistics</td>
<td>3/1</td>
<td>W</td>
<td>6</td>
<td>M. Mittwollen, Madzharov</td>
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<tr>
<td>2117097</td>
<td>Elements of Technical Logistics and Project</td>
<td>4</td>
<td>W</td>
<td>6</td>
<td>M. Mittwollen, Madzharov</td>
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<tr>
<td>2500005</td>
<td>Production and Logistics Controlling</td>
<td>2</td>
<td>W</td>
<td>3</td>
<td>H. Wlcek</td>
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**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.

**Learning Outcomes**  
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**
See German version.
Module: Manufacturing Technology [TVWL4INGMB23]

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

<table>
<thead>
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<th>ECTS Credits</th>
<th>Cycle</th>
<th>Duration</th>
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<tbody>
<tr>
<td>9</td>
<td>Every 2nd term, Winter Term</td>
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Courses in module

<table>
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<tr>
<th>ID</th>
<th>Course</th>
<th>Hours per week</th>
<th>Term</th>
<th>CP</th>
<th>Responsible Lecturer(s)</th>
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<tbody>
<tr>
<td>2149657</td>
<td>Manufacturing Technology</td>
<td>4/2</td>
<td>W</td>
<td>9</td>
<td>V. Schulze, F. Zanger</td>
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</table>

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.

Learning Outcomes
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
270 hours.
Module: Specialization in Production Engineering [TVWL4INGMB22]

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

ECTS Credits: 9  
Cycle: Every term  
Duration: 1

Courses in module

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<tr>
<th>ID</th>
<th>Course</th>
<th>Hours per week</th>
<th>Term</th>
<th>CP</th>
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<tbody>
<tr>
<td>2149667</td>
<td>Quality Management</td>
<td>2 W</td>
<td></td>
<td>4</td>
<td>G. Lanza</td>
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<tr>
<td>2149669</td>
<td>Materials and Processes for Body Lightweight Construction in the Automotive Industry</td>
<td>2 W</td>
<td></td>
<td>4</td>
<td>D. Steegmüller, S. Kienzle</td>
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<tr>
<td>2150681</td>
<td>Metal Forming</td>
<td>2 S</td>
<td></td>
<td>4</td>
<td>T. Herlan</td>
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<tr>
<td>2150683</td>
<td>Control Technology</td>
<td>2 S</td>
<td></td>
<td>4</td>
<td>C. Gönnheimer</td>
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<td>2149555</td>
<td>Gear Cutting Technology</td>
<td>2 W</td>
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<td>4</td>
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<td>2149001</td>
<td>Production Technology and Management in Automotive</td>
<td>2 W</td>
<td></td>
<td>4</td>
<td>V. Stauch, S. Peters</td>
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<tr>
<td>2150601</td>
<td>Integrative Strategies in Production and Development of High Performance Cars</td>
<td>2 S</td>
<td></td>
<td>4</td>
<td>K. Schlichtenmayer</td>
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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.

Learning Outcomes
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
270 hours.
Module: Integrated Production Planning [TVWL4INGMB24]

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

<table>
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Courses in module

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<tr>
<td>2150660</td>
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<td>S</td>
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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.

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

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

270 hours.
Module: Automated Manufacturing Systems [TVWL4INGMBWBK1]

**Coordination:** J. Fleischer  
**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)  
**Subject:** Engineering Science

### Courses in module

<table>
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<tr>
<th>ID</th>
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<tr>
<td>2150904</td>
<td>Automated Manufacturing Systems</td>
<td>4/2</td>
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<td>9</td>
<td>J. Fleischer</td>
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**ECTS Credits:** 9  
**Cycle:** Every 2nd term, Summer Term  
**Duration:** 1

### 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.

### 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

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

270 hours.
Module: Machine Tools and Industrial Handling [TVWL4INGMB32]

Co-ordination: J. Fleischer
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)
Subject: Engineering Science

<table>
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Courses in module

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<th>Responsible Lecturer(s)</th>
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<tr>
<td>2149902</td>
<td>Machine Tools and Industrial Handling</td>
<td>4/2</td>
<td>W</td>
<td>9</td>
<td>J. Fleischer</td>
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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.

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 assess 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

270 hours.
Module: Combustion Engines I [TVWL4INGMB34]

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

<table>
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Courses in module

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<tr>
<th>ID</th>
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<th>Hours per week</th>
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<th>CP</th>
<th>Responsible Lecturer(s)</th>
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<tbody>
<tr>
<td>2133103</td>
<td>Fundamentals of Combustion Engines I</td>
<td>2/1</td>
<td>W</td>
<td>5</td>
<td>H. Kubach, T. Koch</td>
</tr>
<tr>
<td>2133121</td>
<td>Energy Conversion and Increased Efficiency in Internal Combustion Engines</td>
<td>2</td>
<td>W</td>
<td>4</td>
<td>T. Koch, H. Kubach</td>
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</table>

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.

Learning Outcomes
The student can name and explain the working principle 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 Thermodynamics
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 [TVWL4INGMB35]

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

ECTS Credits: 9  Cycle: Every term  Duration: Every term

Courses in module

<table>
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<th>CP</th>
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<tr>
<td>2134131</td>
<td>Fundamentals of Combustion Engines II</td>
<td>2/1</td>
<td>S</td>
<td>5</td>
<td>H. Kubach, T. Koch</td>
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<td>2133108</td>
<td>Fuels and Lubricants for Combustion Engines</td>
<td>2</td>
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<td>2134138</td>
<td>Fundamentals of catalytic exhaust gas aftertreatment</td>
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<td>2134150</td>
<td>Analysis of Exhaust Gas und Lubricating Oil in Combustion Engines</td>
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Learning Control / Examinations
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

The overall grade of the module is the 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.

Learning Outcomes
See courses.

Content

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

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

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<tr>
<td>2118097</td>
<td>Warehousing and distribution systems</td>
<td>2</td>
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<td>M. Schwab, J. Weiblen</td>
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<td>Airport logistics</td>
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Learning Control / Examinations
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Conditions
The course Material Flow in Logistic Systems [2117051] is compulsory and must be examined.

Learning Outcomes
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 [TVWL4INGMB26], [TVWL4INGMB27] and [TVWL4INGMB28] can be chosen.
Module: Material Flow in Networked Logistic Systems [TVWL4INGMB26]

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

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Courses in module

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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.

Learning Outcomes
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 [TVWL4INGMB27]

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

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Courses in module

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<td>2117097</td>
<td>Elements of Technical Logistics and Project</td>
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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 successfully examined in another module, the lecture elements and systems of technical logistics can be chosen instead. If both lectures are examined successfully, one can choose selected applications of technical logistics or selected applications of technical logistics and project instead.

Learning Outcomes
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 [TVWL4INGMB28]

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

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Courses in module

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<td>2118078</td>
<td>Logistics - organisation, design and control of logistic systems</td>
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<tr>
<td>2117062</td>
<td>Supply chain management</td>
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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.

Learning Outcomes

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 [TVWL4INGMB29]

**Coordination:** J. Ovtcharova  
**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)  
**Subject:** Engineering Science

<table>
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#### Courses in module

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<td>2122387</td>
<td>Computer Integrated Planning of New Products</td>
<td>2</td>
<td>S</td>
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<tr>
<td>2123375</td>
<td>Virtual Reality Laboratory</td>
<td>3</td>
<td>W/S</td>
<td>4</td>
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<td>2122376</td>
<td>PLM for product development in mechatronics</td>
<td>2/0</td>
<td>S</td>
<td>4</td>
<td>M. Eigner</td>
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<tr>
<td>2122014</td>
<td>Information Engineering</td>
<td>2</td>
<td>S</td>
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### 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.

### Learning Outcomes

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 [TVWL4INGMB30]

**Coordination:** J. Ovtcharova

**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)

**Subject:** Engineering Science

**ECTS Credits**

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**Courses in module**

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**Learning Control / Examinations**

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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]

**Learning Outcomes**

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: BioMEMS [TVWL4INGMBIMT1]

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

ECTS Credits: 9
Cycle: Every term
Duration: 1

Courses in module

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Learning Control / Examinations
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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

Learning Outcomes
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 [TVWL4INGMBIMT2]

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

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Learning Control / Examinations
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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.

Learning Outcomes
The student
- gains advanced knowledge concerning fabrication techniques in micrometer scale
- acquires 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
If you have any questions concerning the module, please contact Prof. Dr. Andreas E. Guber.
Module: Microoptics [TVWL4INGMBIMT3]

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

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Courses in module

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Learning Control / Examinations
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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 knowledge in electro dynamics is expected.
Attending Grundlagen der Mikrosystemtechnik I [2141861] and Grundlagen der Mikrosystemtechnik II [2142874] is recommended.

Learning Outcomes
- basic knowledge 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
- knowledge on X-ray imaging methods

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 [TVWL4INGMBIMT4]

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

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Learning Control / Examinations
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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.

Learning Outcomes

- 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 [TVWL4INGMBIMT5]

**Coordination:** V. Saile  
**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)  
**Subject:** Engineering Science

### Courses in module

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<td>Nanotechnologie using Scanning Probe Methods</td>
<td>2</td>
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### Learning Control / Examinations

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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.

### Learning Outcomes

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 [TVWL4INGMBIMT6]

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

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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.

Learning Outcomes

- 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 [TVWL4INGMBITS1]

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

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Courses in module

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<th>Term</th>
<th>CP</th>
<th>Responsible Lecturer(s)</th>
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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.

Learning Outcomes
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
The module “Energy and Process technology” replaces the former module “Maschinenkunde/ Energie- und Umwelttechnik” in the diploma studies “Wirtschaftsingenieurwesen” since WS 2012/2013. The content has been slightly changed which will be explained in the first lecture unit. Examination of the lectures “Maschinenkunde I und II” of the old module is possible on request. All lectures and exams are hold in German only.
Module: Energy and Process Technology II [TVWL4INGMBITS2]

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

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### Courses in module

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<td>2170832</td>
<td>Energy and Process Technology II</td>
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**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“.

**Learning Outcomes**

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**

The module “Energy and Process technology” replaces the former module “Maschinenkunde/ Energie- und Umwelttechnik” in the diploma studies “Wirtschaftsingenieurwesen” since WS 2011/2012. The content has been slightly changed which will be explained in the first lecture unit. Examination of the lectures “Maschinenkunde I und II” of the old module is possible on request. All lectures and exams are hold in German only.
Module: High-Voltage Technology [TVWL4INGETIT6]

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

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Courses in module

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<td>23361/23363</td>
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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.

Learning Outcomes
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 [TVWL4INGETIT7]

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

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<td>23372/23374</td>
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<td>2/1</td>
<td>S</td>
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<tr>
<td>23371/23373</td>
<td>Power Network Analysis</td>
<td>2/2</td>
<td>W</td>
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<td>23380</td>
<td>Photovoltaic Systems Technology</td>
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<td>Schmidt</td>
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<td>23392/23394</td>
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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 [TVWL4INGETIT6]. 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.

Learning Outcomes

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 summer term 2015 (repeaters only).
Module: Fundamentals of Transportation [TVWL4INGBGU15]

**Coordination:** P. Vortisch  
**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)  
**Subject:** Engineering Science

<table>
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### Courses in module

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<tr>
<td>19027</td>
<td>Fundamentals of Transportation Planning and Traffic Engineering</td>
<td>2/0</td>
<td>S</td>
<td>3</td>
<td>P. Vortisch, M. Kagerbauer</td>
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<tr>
<td>19035</td>
<td>Exercises in Transportation Planning and Traffic Engineering</td>
<td>0/1</td>
<td>S</td>
<td>1.5</td>
<td>P. Vortisch, M. Kagerbauer</td>
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<tr>
<td>6232806</td>
<td>Characteristics of Transportation Systems</td>
<td>2/0</td>
<td>S</td>
<td>3</td>
<td>P. Vortisch</td>
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<tr>
<td>6232808</td>
<td>Freight Transport</td>
<td>1/1</td>
<td>S</td>
<td>3</td>
<td>B. Chlond</td>
</tr>
<tr>
<td>6232904</td>
<td>Long-distance and Air Traffic</td>
<td>2/0</td>
<td>W</td>
<td>3</td>
<td>B. Chlond, N.N., Wilko Manz</td>
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<tr>
<td>6232807</td>
<td>Tendering, Planning and Financing in Public Transport</td>
<td>2/0</td>
<td>S</td>
<td>3</td>
<td>W. Weißkopf</td>
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<tr>
<td>6232903</td>
<td>Seminar in Transportation</td>
<td>2</td>
<td>W/S</td>
<td>3</td>
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<tr>
<td>2595475</td>
<td>Seminar Mobility Services</td>
<td>2</td>
<td>W</td>
<td>4</td>
<td>W. Michalk, B. Chlond, U. Leyn, H. Fromm</td>
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</table>

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 [19027] 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 Exercises in Transportation Planning and Traffic Engineering [19035], 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 [19027] and Characteristics of Transportation Systems [6232806]. Otherwise only the core course Characteristics of Transportation Systems [6232806] should be chosen.

Learning Outcomes
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 [TVWL4INGBGU16]

Coordinator: P. Vortisch
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)
Subject: Engineering Science

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<td>6232703</td>
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<tr>
<td>6232802</td>
<td>Traffic Management and Transport Telematics</td>
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<td>6232804</td>
<td>Traffic Flow Simulation</td>
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<tr>
<td>6232901</td>
<td>Transportation Data Analysis</td>
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<td>W</td>
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<td>S</td>
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<td>B. Chlond</td>
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<td>2/0</td>
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<td>B. Chlond, N.N., Wilko Manz</td>
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<tr>
<td>6232807</td>
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<td>S</td>
<td>3</td>
<td>W. Weißkopf</td>
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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 required 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.

Learning Outcomes

See German version.

Content

Workload

The total workload for this module is approximately 270 hours. For further information see German version.
Module: Mechanical Process Engineering in Construction [TVWL4INGBGU17]

Coordination: S. Haghsheno, H. Schneider, H. Schlick
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)
Subject: Engineering Science

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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.
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.

Conditions
The course Construction Equipment and Mechanical Process Engineering [6241704] is compulsory and must be examined.

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

Learning Outcomes
Students understand construction methods and the related construction equipment, their technology, capabilities and constraints. Students can define construction methods consisting of machinery and devices. They can evaluate existing methods through knowledge about process performance and operating conditions, and can identify potential for improvement.

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

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

Remarks
The module [TVWL4INGBGU17] will not be offered any more from winter term 2014/15. It will be replaced by the module [TVWL4INGBGU22]. Students who are already assigned on the module [TVWL4INGBGU17] can still finish it until winter term 2015/16.
Module: Process Engineering in Construction [TVWL4INGBGU22]

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

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**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.

**Learning Outcomes**
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.

**Remarks**
The module will be offered from winter term 2014/15.
Module: Logistics and Management of Track Guided Transport Systems [TVWL4INGBGU21]

Coordination: M. Weigel
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)
Subject: Engineering Science

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Courses in module

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<tbody>
<tr>
<td>6234701</td>
<td>Track Guided Transport Systems - Technical Design and Components</td>
<td>3/1</td>
<td>W</td>
<td>6</td>
<td>E. Hohnecker</td>
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<tr>
<td>6234805</td>
<td>Management in Public Transport</td>
<td>2</td>
<td>S</td>
<td>3</td>
<td>E. Hohnecker</td>
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<tr>
<td>6234903</td>
<td>Law Aspects of Guided Transport Systems</td>
<td>1</td>
<td>W</td>
<td>1,5</td>
<td>N. N.</td>
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<tr>
<td>6234902</td>
<td>Economic Efficiency of Guided Transport Systems</td>
<td>1</td>
<td>W</td>
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<td>E. Hohnecker</td>
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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.

Learning Outcomes
See German version.

Content
See courses.

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

Remarks
See German version.
Module: Project in Public Transportation [TVWL4INGBGU18]

Coordination: M. Weigel
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)
Subject: Engineering Science

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<td>6234810</td>
<td>Determination of Demand, Timetable Construction and Alignment</td>
<td>1/2</td>
<td>S</td>
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<td>E. Hohnecker</td>
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<td>6234904</td>
<td>Standard Valuation in Public Transport-Example</td>
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<td>W</td>
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<td>6234902</td>
<td>Economic Efficiency of Guided Transport Systems</td>
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<td>W</td>
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<td>E. Hohnecker</td>
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<tr>
<td>6232807</td>
<td>Tendering, Planning and Financing in Public Transport</td>
<td>2/0</td>
<td>S</td>
<td>3</td>
<td>W. Weißkopf</td>
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Learning Control / Examinations
See German version.

Conditions
See German version.

Recommendations
See German version.

Learning Outcomes
See German version.

Content
See courses.

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

Remarks
See German version.
Module: Public Transportation Operations [TVWL4INGBGU19]

Coordination: M. Weigel
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)
Subject: Engineering Science

ECTS Credits: 9
Cycle: Every term
Duration: 2

Courses in module

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<td>Operation Systems and Track Guided Infrastructure Capacity</td>
<td>2</td>
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<td>6234805</td>
<td>Management in Public Transport</td>
<td>2</td>
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<td>6234901</td>
<td>Environmental Aspects of Guided Transport Systems</td>
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<td>W</td>
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<td>19307s / 6234809</td>
<td>Construction and Maintenance of Guided Track Infrastructure</td>
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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.

Learning Outcomes
See German version.

Content
See courses.

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

Remarks
See German version.
Module: Track Guided Transport Systems / Engineering [TVWL4INGBGU20]

Coordination: M. Weigel
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)
Subject: Engineering Science

ECTS Credits: 9  Cycle: Every term  Duration: 1

Courses in module

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<td>Infrastructure Dimensioning and Running Dynamics based Railway Alignment</td>
<td>1/1</td>
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<td>6234808</td>
<td>Infrastructure Equipment of Railway Tracks</td>
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<tr>
<td>19307s / 6234809</td>
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<tr>
<td>6232808</td>
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<td>S</td>
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<td>2114346</td>
<td>Electric Rail Vehicles</td>
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Learning Control / Examinations
See German version.

Conditions
See German version.

Recommendations
See German version.

Learning Outcomes
See German version.

Content
See courses.

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

Remarks
See German version.
Module: Principles of Food Process Engineering [TVWL4INGCV3]

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

ECTS Credits: 9
Cycle: Every term
Duration: 2

Courses in module

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<th>ID</th>
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<td>22213</td>
<td>Principles of Food Process Engineering</td>
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<td>22214</td>
<td>Specialization in Principles of Process Engineering referring to food</td>
<td>2/0</td>
<td>S</td>
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<tr>
<td>22205/6</td>
<td>Quality Management of Food Processing</td>
<td>1/1</td>
<td>S</td>
<td>3</td>
<td>Schuchmann</td>
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<tr>
<td>22207</td>
<td>Food Science and Functionality</td>
<td>2</td>
<td>W</td>
<td>4</td>
<td>Watzl</td>
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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 overall grade of the module is the grade of 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.

Learning Outcomes
See German version.

Content

Workload
See German version.
**Module: Specialization in Food Process Engineering [TVWL4INGCV4]**

**Coordination:** V. Gaukel  
**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)  
**Subject:** Engineering Science

### ECTS Credits

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<tbody>
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<td>22205/6</td>
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<td>1/1</td>
<td>S</td>
<td>3</td>
<td>Schuchmann</td>
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<td>W</td>
<td>4</td>
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<td>6635</td>
<td>Microbiology of Food</td>
<td>2</td>
<td>W</td>
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<td>Franz</td>
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<td>22215</td>
<td>Product Design</td>
<td>2</td>
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<td>Schuchmann</td>
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<td>22218</td>
<td>Modern Measurement Techniques for Process Optimization</td>
<td>2</td>
<td>S</td>
<td>4</td>
<td>Regier</td>
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<td>6602</td>
<td>Fundamentals of Food Chemistry</td>
<td>2</td>
<td>W/S</td>
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<td>22229</td>
<td>Emulsifying and Dispersing</td>
<td>2</td>
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<td>4</td>
<td>Köhler</td>
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</table>

**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 overall grade of the module is the grade of the general oral exam.

**Conditions**

It is only possible to choose this module in combination with the module Principles of Food Process Engineering [TVWL4INGCV3]. 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.

**Learning Outcomes**

See German version.

**Content**

See courses.

**Workload**

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 [TVWL4INGCV6]

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

<table>
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Courses in module

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<th>CP</th>
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<tbody>
<tr>
<td>22601</td>
<td>Chemical Technology of Water</td>
<td>2</td>
<td>W</td>
<td>4</td>
<td>H. Horn</td>
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<tr>
<td>22602</td>
<td>Exercises in Chemical Technology of Water</td>
<td>1</td>
<td>W</td>
<td>2</td>
<td>H. Horn, Mitarbeiter</td>
</tr>
<tr>
<td>22664</td>
<td>Laboratory Work “Water”</td>
<td>2</td>
<td>W</td>
<td>4</td>
<td>H. Horn, G. Abbt-Braun</td>
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</table>

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 exercises weighted by credit points.

Conditions
None.

Learning Outcomes
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 [TVWL4INGCV7]

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

ECTS Credits: 9
Cycle: Every term
Duration: 2

Courses in module

<table>
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<td>Scientific Bases for Examination and Assessement of Water Quality</td>
<td>2</td>
<td>W</td>
<td>4</td>
<td>G. Abbt-Braun</td>
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<tr>
<td>22618</td>
<td>Fundamentals of Waste Water Treatment</td>
<td>2</td>
<td>S</td>
<td>4</td>
<td>S. Lackner</td>
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<tr>
<td>22612</td>
<td>Oxidation and Desinfection Processes</td>
<td>2</td>
<td>S</td>
<td>4</td>
<td>H. Horn</td>
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<tr>
<td>22605</td>
<td>Membrane Separation in Water Treatment</td>
<td>2</td>
<td>W</td>
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<td>H. Horn, F. Saravia</td>
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</table>

Learning Control / Examinations

Conditions
It is only possible to choose this module in combination with the module Water Chemistry I [TVWL4INGCV6]. The module is passed only after the final partial exam of Water Chemistry I is additionally passed.

Learning Outcomes
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 [TVWL4INGINTER7]

Coordination: M. Kunz
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)
Subject: Engineering Science

<table>
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Courses in module

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<td>19203</td>
<td>Morphodynamics of Rivers and Streams</td>
<td>1/1</td>
<td>S</td>
<td>3</td>
<td>F. Nestmann</td>
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<tr>
<td>19212</td>
<td>Environment Communication</td>
<td>2/1</td>
<td>W</td>
<td>4</td>
<td>Kämpf</td>
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<tr>
<td>8048</td>
<td>River Engineering and Ecology I</td>
<td>2</td>
<td>W</td>
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<tr>
<td>8056</td>
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<td>2</td>
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<tr>
<td>2600211/212</td>
<td>Geophysical Engineering</td>
<td>1/1</td>
<td>S</td>
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<td>0170617</td>
<td>Water Resource Management and Engineering Hydrology</td>
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<td>2</td>
<td>W</td>
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<td>9050</td>
<td>Basics in Hydrogeology</td>
<td>2/2</td>
<td>W</td>
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<td>N. Goldscheider</td>
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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.

Learning Outcomes
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 [TVWL4INGINTER8]

**Coordination:** M. Kunz  
**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)  
**Subject:** Engineering Science

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#### Courses in module

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<tr>
<td>19203</td>
<td>Morphodynamics of Rivers and Streams</td>
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<td>3</td>
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<tr>
<td>19212</td>
<td>Environment Communication</td>
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<td>W</td>
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<td>Kämpf</td>
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<tr>
<td>8048</td>
<td>River Engineering and Ecology I</td>
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<td>8056</td>
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<td>3.5</td>
<td>Kottmeier</td>
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<td>W</td>
<td>5</td>
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#### 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.

#### Learning Outcomes

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 [TVWL4INGAPL]

Coordination: Prüfer einer Ingenieurwissenschaftlichen Fakultät
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)
Subject: Engineering Science

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Learning Control / Examinations
The assessment of the module is determined by the respective module coordinator. 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.

Learning Outcomes
See German version.

Content

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


**Coordination:** T. Dreier  
**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)  
**Subject:** Law

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### Courses in module

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<td>W</td>
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<td>W/S</td>
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### 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.

### Learning Outcomes

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 [TVWL4JURA5]

Coordination: Z. (ZAR)
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)
Subject: Law

ECTS Credits 9
Cycle Every term
Duration 1

Courses in module

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<td>24671</td>
<td>Law of Contracts</td>
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<td>S</td>
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<td>Z. (ZAR)</td>
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<td>24167</td>
<td>Employment Law I</td>
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<td>S</td>
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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.

Learning Outcomes
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 [TVWL4JURA6]

Coordination: G. Sydow
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)
Subject: Law

<table>
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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.

Learning Outcomes
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 [TVWL4INGRC]

Coordination: T. Dreier
Degree programme: Technische Volkswirtschaftslehre (M.Sc.)

Subject:

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Courses in module

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Learning Control / Examinations

Conditions
None.

Learning Outcomes
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 [TVWL4SOZ1]

<table>
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<tr>
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<td>spezSoz</td>
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Learning Control / Examinations
The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

The overall grade 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.

Learning Outcomes
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 phenomena 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 [TVWL4SEM]**

**Coordination:** Studiendekan (Fak. f. Wirtschaftswissenschaften)

**Degree programme:** Technische Volkswirtschaftslehre (M.Sc.)

**Subject:**

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#### Courses in module

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<td>SemAIFB1</td>
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<tr>
<td>SemAIFB2</td>
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<td>SemWIOR2</td>
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</table>

Economics Engineering (M.Sc.)

Module Handbook, Date: 21.08.2014
Learning Control / Examinations
The module examination consists of two seminars and at least one key qualification (KQ) course (according to §4 (3), 3 of the examination regulation). A detailed description of every single assessment is given in the specific course characterization. The final mark for the module is the average of the marks for each seminar 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 an 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].

Learning Outcomes
The student

- investigates with a selected topic in a special subject,
- analyses and discusses topical issues in the course and within the final term paper,
- discusses, presents and defends subject-specific arguments within the given topic,
- plans and realizes the final term paper mostly autonomous.

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 detailed description of 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
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: http://www.wiwi.kit.edu/2361.php.
Module: Master Thesis [TVWL4THESIS]

Coordination: Der Vorsitzende des Prüfungsausschusses

Degree programme: Technische Volkswirtschaftslehre (M.Sc.)

ECTS Credits: 30

Learning Control / Examinations
See German version.

Conditions
See German version.

Learning Outcomes
See German version.

Content

Workload
The total workload for this module is approximately 900 hours. For further information see German version.

Die Absolvent/innen sind in der Lage, die Besonderheiten, Grenzen, Terminologien und Lehrmeinungen in den gewählten Themengebieten dieser Fächer zu definieren, zu beschreiben, zu interpretieren, den aktuellen Forschungsstand wiederzugeben sowie punktuell weiterzuentwickeln. Ihr breites Wissen ermöglicht ihnen, interdisziplinär zu denken und Trends sowie gesamtwirtschaftliche Entwicklungen frühzeitig zu erkennen.


Der interdisziplinäre Umgang mit dem Fachwissen erfolgt unter Berücksichtigung von gesellschaftlichen, wissenschaftlichen und ethischen Erkenntnissen.

Prüfungs- und Studienordnung der Universität Karlsruhe (TH) für den Masterstudiengang Technische Volkswirtschaftslehre


Der Rektor hat seine Zustimmung am 06.03.2007 erteilt.

In dieser Satzung ist nur die männliche Sprachform gewählt worden. Alle personenbezogenen Aussagen gelten jedoch stets für Frauen und Männer gleichermaßen.

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   § 5 Anmeldung und Zulassung zu den Prüfungen
   § 6 Durchführung von Prüfungen und Erfolgskontrollen
   § 7 Bewertung von Prüfungen und Erfolgskontrollen
   § 8 Erlöschen des Prüfungsanspruchs, Wiederholung von Prüfungen und Erfolgskontrollen
   § 9 Versäumnis, Rücktritt, Täuschung, Ordnungsverstoß
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   § 20 Aberkennung des Mastergrades
   § 21 Einsicht in die Prüfungsakten
   § 22 In-Kraft-Treten

APPENDIX: STUDY- AND EXAMINATION REGULATION (06/03/2007, IN GERMAN)

Economics Engineering (M.Sc.)
Module Handbook, Date: 21.08.2014
I. Allgemeine Bestimmungen

§ 1 Geltungsbereich, Ziele
(1) Diese Masterprüfungsordnung regelt Studienablauf, Prüfungen und den Abschluss des Studiums im Masterstudiengang Technische Volkswirtschaftslehre 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 Technische Volkswirtschaftslehre verliehen.

§ 3 Regelstudienzeit, Studienaufbau, Leistungspunkte
(1) Die Regelstudienzeit beträgt vier Semester. Sie umfasst Prüfungen und die Masterarbeit.
(2) Die im Studium zu absolviierenden 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.
(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
(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.
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 Technischer Volkswirtschaftslehre vergleichbaren oder einem verwandten Studiengang bereits eine Diplomprüfung, 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.


(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.


(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:

<table>
<thead>
<tr>
<th>Wert</th>
<th>Bewertung (German)</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>sehr gut (very good)</td>
<td>hervorragende Leistung</td>
</tr>
<tr>
<td>2</td>
<td>gut (good)</td>
<td>eine Leistung, die erheblich über den durchschnittlichen Anforderungen liegt</td>
</tr>
<tr>
<td>3</td>
<td>befriedigend (satisfactory)</td>
<td>eine Leistung, die durchschnittlichen Anforderungen entspricht</td>
</tr>
<tr>
<td>4</td>
<td>ausreichend (sufficient)</td>
<td>eine Leistung, die trotz ihrer Mängel noch den Anforderungen genügt</td>
</tr>
<tr>
<td>5</td>
<td>nicht ausreichend (failed)</td>
<td>eine Leistung, die wegen erheblicher Mängel nicht den Anforderungen genügt</td>
</tr>
</tbody>
</table>

Für die Masterarbeit und die Modulteilprüfungen sind zur differenzierten Bewertung nur folgende Noten zugelassen:

<table>
<thead>
<tr>
<th>Wert</th>
<th>Bewertung (German)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.0, 1.3</td>
</tr>
<tr>
<td>2</td>
<td>1.7, 2.0, 2.3</td>
</tr>
<tr>
<td>3</td>
<td>2.7, 3.0, 3.3</td>
</tr>
<tr>
<td>4</td>
<td>3.7, 4.0</td>
</tr>
<tr>
<td>5</td>
<td>4.7, 5.0</td>
</tr>
</tbody>
</table>

Diese Noten müssen in den Protokollen und in den Anlagen (Transcript of Records und Diploma Supplement) verwendet werden.
Für Erfolgskontrollen anderer Art kann die Benotung „bestanden“ (passed) oder „nicht bestanden“ (failed) vergeben werden.

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.

Jedes Modul, jede Lehrveranstaltung und jede Erfolgskontrolle darf jeweils nur einmal angezählt werden.

Erfolgskontrollen anderer Art dürfen in Modulteilprüfungen oder Modulprüfungen nur eingezählt 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.

Eine Modulteilprüfung ist bestanden, wenn die Note mindestens „ausreichend“ (4.0) ist.


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.

Die Ergebnisse der Masterarbeit, der Modulprüfungen bzw. der Modulteilprüfungen, der Erfolgskontrollen anderer Art sowie die erworbenen Leistungspunkte werden durch das Studienbüro der Universität erfasst.

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 Zusatztachprüfungen nach § 12 nachträglich geltend gemacht werden.

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:

<table>
<thead>
<tr>
<th>ECTS-Note</th>
<th>Quote</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>10</td>
<td>gehört zu den besten 10 % der Studierenden, die die Erfolgskontrolle bestanden haben</td>
</tr>
<tr>
<td>B</td>
<td>25</td>
<td>gehört zu den nächsten 25 % der Studierenden, die die Erfolgskontrolle bestanden haben</td>
</tr>
<tr>
<td>C</td>
<td>30</td>
<td>gehört zu den nächsten 30 % der Studierenden, die die Erfolgskontrolle bestanden haben</td>
</tr>
<tr>
<td>D</td>
<td>25</td>
<td>gehört zu den nächsten 25 % der Studierenden, die die Erfolgskontrolle bestanden haben</td>
</tr>
<tr>
<td>E</td>
<td>10</td>
<td>gehört zu den letzten 10 % der Studierenden, die die Erfolgskontrolle bestanden haben</td>
</tr>
<tr>
<td>FX</td>
<td>nicht bestanden (failed) – es sind Verbesserungen erforderlich, bevor die Leistungen anerkannt werden</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>nicht bestanden (failed) – es sind erhebliche Verbesserungen erforderlich</td>
<td></td>
</tr>
</tbody>
</table>

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.


(4) Die Wiederholung einer Erfolgskontrolle anderer Art (§ 4 Absatz 2 Nr. 3) wird im Modulhandbuch geregelt.


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.

(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.

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


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 Modulkontrollen, die aus mehreren Prüfungen bestehen, werden die Prüfungsleistungen dieses Moduls, die bis zu einem anerkannten Rücktritt bzw. einem anerkannten Versäumnis eingerufener 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.


(7) Näheres regelt die Allgemeine Satzung der Universität Karlsruhe (TH) zur Redlichkeit bei Prüfungen und Praktika.

§ 10 Mutterschutz, Elternzeit


§ 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.


(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.


(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 Studiierenden 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.


§ 12 Zusatzmodule, Zusatzleistungen

(1) Der Studierende kann sich weiteren Prüfungen in Modulen unterziehen. § 3, § 4 und § 8 Absatz 10 der Prüfungsordnung bleiben davon unberührt.


(3) Der Studierende hat bereits bei der Anmeldung zu einer Prüfung in einem Modul diese als Zusatzleistung zu deklarieren.

§ 13 Prüfungsausschuss


(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.


(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.


§ 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

(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 Technische Volkswirtschaftslehre 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 Berufskademien 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. Volkswirtschaftslehre: zwei Module im Umfang von je 9 Leistungspunkten,
2. Betriebswirtschaftslehre: 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,


(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 mindes tens 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


(2) Das Zeugnis enthält die in den Fachprüfungen, den Modulprüfungen sowie dem Seminar modul 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.


(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 Rechtsbelehrung 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 Mastergrads

(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 erworben, 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.


(6) Die Aberkennung des akademischen Grads 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.


(3) Prüfungsunterlagen sind mindestens fünf Jahre aufzubewahren.
§ 22 In-Kraft-Treten


(2) Gleichzeitig tritt die Prüfungsordnung der Universität Karlsruhe (TH) für den Diplomstudien-
gang Technische Volkswirtschaftslehre vom 22. Dezember 1995, zuletzt geändert durch Satzung
vom 17. September 1999 (Amtliche Bekanntmachung der Universität Karlsruhe (TH), Nr. 4 vom
9. März 2000) außer Kraft, behält jedoch ihre Gültigkeit bis zum 30. September 2013 für Prüflin-
ge, die auf Grundlage der Prüfungsordnung der Universität Karlsruhe (TH) für den Studiengang
Technische Volkswirtschaftslehre vom 22. Dezember 1995 ihr Studium an der Universität Karls-
ruhe (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 Prü-
fungsordnung der Universität Karlsruhe (TH) für den Studiengang Technische Volkswirtschafts-
lehre vom 22. Dezember 1995 ihr Studium an der Universität Karlsruhe (TH) aufgenommen ha-
ben, 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 Technische Volkswirtschaftslehre

Die Regelstudienzeit im Masterstudiengang Technische Volkswirtschaftslehre 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 Probleme zu bearbeiten.


Die folgende Abbildung zeigt die Fach- und Modulstruktur und die Zuordnung der Leistungspunkte zu den Fächern. Im Wahlbereich sind aus den angegebenen Fächern vier Module zu wählen, pro Fach maximal zwei Module und in den Fächern Recht und Soziologie in Summe maximal ein Modul.

<table>
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Σ (6 Pflichtmodule + 4 Wahlpflichtmodule) : 90

Σ Master : 120
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