Module Catalog

B.Sc. Management and Technology

TUM School of Management

Technische Universität München

www.tum.de
www.wi.tum.de
Module Catalog: General Information and Notes to the Reader

What is the module catalog?
One of the central components of the Bologna Process consists in the modularization of university curricula, that is, the transition of universities away from earlier seminar/lecture systems to a modular system in which thematically-related courses are bundled together into blocks, or modules. This module catalog contains descriptions of all modules offered in the course of study. Serving the goal of transparency in higher education, it provides students, potential students and other internal and external parties with information on the content of individual modules, the goals of academic qualification targeted in each module, as well as their qualitative and quantitative requirements.

Notes to the reader:

Updated Information
An updated module catalog reflecting the current status of module contents and requirements is published every semester. The date on which the module catalog was generated in TUMonline is printed in the footer.

Non-binding Information
Module descriptions serve to increase transparency and improve student orientation with respect to course offerings. They are not legally-binding. Individual modifications of described contents may occur in praxis. Legally-binding information on all questions concerning the study program and examinations can be found in the subject-specific academic and examination regulations (FPSO) of individual programs, as well as in the general academic and examination regulations of TUM (APSO).

Elective modules
Please note that generally not all elective modules offered within the study program are listed in the module catalog.
### Index

[20191] Bachelor's Program in Management & Technology | 7

#### Basics

Basic Courses (18 Cr have to be passed till the end of the 2nd semester) | 8

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>WI000021</td>
<td>Economics I - Microeconomics</td>
<td>10 - 11</td>
</tr>
<tr>
<td>WI000021_E</td>
<td>Economics I - Microeconomics</td>
<td>12 - 13</td>
</tr>
<tr>
<td>MA9711</td>
<td>Mathematics in Natural and Economic Science 1</td>
<td>14 - 15</td>
</tr>
<tr>
<td>MA9712</td>
<td>Statistics for Business Administration</td>
<td>16 - 17</td>
</tr>
<tr>
<td>WI000275_E</td>
<td>Management Science</td>
<td>18 - 19</td>
</tr>
</tbody>
</table>

Basics in Management | 20

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>WI001059</td>
<td>Financial Accounting and Reporting</td>
<td>22 - 23</td>
</tr>
<tr>
<td>WI001059_E</td>
<td>Financial Accounting</td>
<td>24 - 25</td>
</tr>
</tbody>
</table>

Cost Accounting | 26

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>WI001057</td>
<td>Cost Accounting</td>
<td>27 - 28</td>
</tr>
<tr>
<td>WI001057_E</td>
<td>Cost Accounting</td>
<td>29 - 30</td>
</tr>
</tbody>
</table>

Investment and Financial Management | 31

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>WI000219</td>
<td>Investment and Financial Management</td>
<td>32 - 33</td>
</tr>
<tr>
<td>WI000219_E</td>
<td>Investment and Financial Management</td>
<td>34 - 35</td>
</tr>
<tr>
<td>WI0000261</td>
<td>Empirical Research Methods</td>
<td>36 - 39</td>
</tr>
<tr>
<td>WI000820</td>
<td>Marketing and Innovation Management</td>
<td>40 - 42</td>
</tr>
<tr>
<td>WI001058</td>
<td>Foundations of Entrepreneurial &amp; Ethical Business</td>
<td>43 - 45</td>
</tr>
<tr>
<td>WI001060</td>
<td>Production and Logistics</td>
<td>46 - 47</td>
</tr>
<tr>
<td>WI001121</td>
<td>Strategic and International Management &amp; Organizational Behavior</td>
<td>48 - 50</td>
</tr>
</tbody>
</table>

Basics in Economics | 51

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>WI000023</td>
<td>Economics II - Macroeconomics</td>
<td>52 - 53</td>
</tr>
<tr>
<td>WI000023_E</td>
<td>Economics II - Macroeconomics</td>
<td>54 - 55</td>
</tr>
</tbody>
</table>

Basics in Law | 56

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>WI000027</td>
<td>German Business Law I</td>
<td>58 - 59</td>
</tr>
<tr>
<td>WI000030</td>
<td>German Business Law II</td>
<td>60 - 61</td>
</tr>
<tr>
<td>WI001119</td>
<td>Business Law I</td>
<td>63 - 64</td>
</tr>
<tr>
<td>WI001120</td>
<td>Business Law II</td>
<td>65 - 66</td>
</tr>
</tbody>
</table>

Specialization in Technology | 67

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH0106</td>
<td>Biology for Chemists</td>
<td>69 - 70</td>
</tr>
</tbody>
</table>
[CH0107] Analytical Chemistry 71 - 72
[CH0575] General and Inorganic Chemistry [CH0575] 73 - 74
[CH0999] Chemistry Software and Databases for TUM-BWL 75 - 76
[CH1000] Chemical Laboratory Course for TUM-BWL 77 - 79
[CH1090] Introduction to Organic Chemistry 80 - 81
[CH1091] Basic Principles of Physical Chemistry 1 82 - 83
[CH1123] Chemical Engineering for TUM-BWL 84 - 85

Specialization in Technology: Informatics
Required Modules Informatics 86

[IN0001] Introduction to Informatics 1 88 - 89
[IN0002] Fundamentals of Programming (Exercises & Laboratory) 90 - 91
[IN0006] Introduction to Software Engineering 92 - 93
[IN0008] Fundamentals of Databases 94 - 95
[IN0009] Basic Principles: Operating Systems and System Software 96 - 97
[IN8024] Information Management for Digital Business Models 98 - 99

Elective Modules Informatics

[IN0003] Functional Programming and Verification 100 - 102
[IN2119] User Modeling and Recommender Systems 103 - 104

Specialization in Technology: Electrical Engineering and Information Technology 105

Required Modules Electrical Engineering and Information Technology 106

[EL1289] Electrical Engineering 111 - 112
[EL29821] Principles of Information Engineering 113 - 114
[EL2986] Telecommunication I - Signal Representation 115 - 116
[IN8005] Introduction into Computer Science (for non Informatics studies) 117 - 118

Elective Modules Electrical Engineering and Information Technology

[EL0602] Audio Communication 121 - 123
[EL0644] Photovoltaic Stand Alone Systems [PVI] 124 - 125

Specialization in Technology: Mechanical Engineering 126

Required Modules Mechanical Engineering 127

[BV350007] Materials in Mechanical Engineering 128 - 129
[IN8005] Introduction into Computer Science (for non Informatics studies) 130 - 131
[MW2385] CAD and Machines Drawing (Specialization/Application Area) [CADundMZ] 138 - 140

Elective Modules Mechanical Engineering 143
[MW1903] Bioprocess Engineering
[MW2156] Metal-cutting Manufacturing Processes  [SFV]

Specialization in Technology: Computer Engineering
[EI10001] Principles of Information Engineering  [PIE]  
[EI10002] Principles of Electrotechnology  [PIET]  
[EI10003] Analog Electronics  [AE]  
[EI5183] Control Theory (MSE)  
[IN0003] Functional Programming and Verification  
[IN0006] Introduction to Software Engineering  
[IN2113] Programming Languages  
[IN2119] User Modeling and Recommender Systems  
[IN2161] Networks for Monetary Transactions  
[IN2339] Data Analysis and Visualization in R  
[IN8005] Introduction into Computer Science (for non Informatics studies)  
[IN8024] Information Management for Digital Business Models  

Specialization in Technology: Renewable Resources
Required Modules Renewable Resources  
[CS0077] Fundamentals of Thermodynamics  
[WZS0001] Physics  
[WZS0002] General and Inorganic Chemistry  
[WZS0003] Organic Chemistry  
[WZS0005] Forestry and Wood  
[WZS0006] Introduction into Computer Science
Elective Modules Renewable Resources  
[WZS0008] Physical Chemistry  
[WZS0015] Electrical Engineering

Specialization in Technology: Medical Science
[MEDW001] Chemistry - Basic knowledge with clinical links  
[WZ8057] Biology Part 1  
[SG120020] Composition and Function of the Human Body  
[SG120025] Human Biology  
[MEDW002] Medical terminology  
[MEDW003] Medical Focus  
[MEDW004] Medical Science and Practice  
[IN8005] Introduction into Computer Science (for non Informatics studies)

Project Studies  
[WI0000684] Project Studies

Electives in Management and/or Technology
Chemistry

144 - 145
146 - 147
148
149 - 150
151 - 152
153 - 154
155 - 156
157 - 158
159 - 160
161 - 162
163 - 164
165 - 166
167 - 168
169 - 170
171 - 172
173 - 174
175
176
177 - 178
179 - 180
181 - 182
183 - 184
185 - 186
187 - 188
189
190 - 191
192 - 193
194
195 - 196
197 - 198
199 - 200
201 - 202
203 - 204
205 - 207
208 - 209
210 - 211
212
213 - 214
215
216
<table>
<thead>
<tr>
<th>Module</th>
<th>Code</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>General and Inorganic Chemistry</td>
<td>CH0575</td>
<td>217 - 218</td>
</tr>
<tr>
<td>Computer Engineering</td>
<td></td>
<td>219</td>
</tr>
<tr>
<td>Principles of Information Engineering</td>
<td>PIE</td>
<td>220 - 221</td>
</tr>
<tr>
<td>Innovation and Entrepreneurship</td>
<td></td>
<td>222</td>
</tr>
<tr>
<td>Advanced Technology and Innovation Management</td>
<td>EI100026</td>
<td>223 - 224</td>
</tr>
<tr>
<td>Innovative Entrepreneurs - Leadership of High-Tech Organizations</td>
<td>EI000285</td>
<td>225 - 227</td>
</tr>
<tr>
<td>Intellectual Property Management in the Global Market Place</td>
<td>EI001143</td>
<td>228 - 229</td>
</tr>
<tr>
<td>Marketing, Strategy and Leadership</td>
<td></td>
<td>230</td>
</tr>
<tr>
<td>High Performance Leadership</td>
<td>W000096</td>
<td>231 - 232</td>
</tr>
<tr>
<td>Basic Principles and international Aspects of Corporate Management</td>
<td>W0001028</td>
<td>233 - 234</td>
</tr>
<tr>
<td>Evidence Based Decisions Using Big Data Analytics</td>
<td>EEBDA</td>
<td>235 - 236</td>
</tr>
<tr>
<td>Operations and Supply Chain Management</td>
<td></td>
<td>237</td>
</tr>
<tr>
<td>Topics in Operations &amp; Supply Chain Management I</td>
<td>WIB19807</td>
<td>238 - 239</td>
</tr>
<tr>
<td>Project Management</td>
<td>W000264</td>
<td>240 - 241</td>
</tr>
<tr>
<td>Transportation Logistics</td>
<td>W000978</td>
<td>242 - 243</td>
</tr>
<tr>
<td>Finance and Accounting</td>
<td></td>
<td>244</td>
</tr>
<tr>
<td>Corporate Finance</td>
<td>W000091</td>
<td>245 - 246</td>
</tr>
<tr>
<td>Controlling</td>
<td>W0001083</td>
<td>247 - 248</td>
</tr>
<tr>
<td>Law of Business Association 2</td>
<td>W001108</td>
<td>249 - 250</td>
</tr>
<tr>
<td>Informatics</td>
<td></td>
<td>251</td>
</tr>
<tr>
<td>Introduction to Informatics 1</td>
<td>IN0001</td>
<td>252 - 253</td>
</tr>
<tr>
<td>Electrical Engineering and Information Technology</td>
<td></td>
<td>254</td>
</tr>
<tr>
<td>Photovoltaic Stand Alone Systems</td>
<td>EI0644</td>
<td>255 - 256</td>
</tr>
<tr>
<td>Principles of Electrotechnology</td>
<td>EI10002</td>
<td>257 - 258</td>
</tr>
<tr>
<td>Analog Electronics</td>
<td>EI10003</td>
<td>259 - 260</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td></td>
<td>261</td>
</tr>
<tr>
<td>Machine Elements - Basics, Manufacturing, Application</td>
<td>MW1694</td>
<td>262 - 263</td>
</tr>
<tr>
<td>Engineering Mechanics for Technology Management</td>
<td>MW1108</td>
<td>264 - 265</td>
</tr>
<tr>
<td>Renewable Resources</td>
<td></td>
<td>266</td>
</tr>
<tr>
<td>Forestry and Wood</td>
<td>WZS0005</td>
<td>267 - 268</td>
</tr>
<tr>
<td>Basics Plant Growing</td>
<td>WZS0014</td>
<td>269 - 270</td>
</tr>
<tr>
<td>Economics &amp; Policy</td>
<td></td>
<td>271</td>
</tr>
<tr>
<td>Energy &amp; Climate Policy</td>
<td>W001183</td>
<td>272 - 273</td>
</tr>
<tr>
<td>International Experience &amp; Communication Skills</td>
<td></td>
<td>274</td>
</tr>
<tr>
<td>International Experience</td>
<td>W0001197</td>
<td>275 - 276</td>
</tr>
<tr>
<td>Communication Skills</td>
<td>W001198</td>
<td>277 - 279</td>
</tr>
<tr>
<td>Bachelor's Thesis</td>
<td></td>
<td>280</td>
</tr>
<tr>
<td>Bachelor's Thesis</td>
<td>W000693</td>
<td>281 - 282</td>
</tr>
</tbody>
</table>
Basics
Basic Courses (18 Cr have to be passed till the end of the 2nd semester)
Economics I
Module Description

WI000021: Economics I - Microeconomics [ECON 1]

Microeconomics
TUM School of Management

Module Level: Bachelor
Language: German/English

Credits: 6
Total Hours: 180
Self-study Hours: 120
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
In the exam (written, 120 minutes) students should demonstrate their ability to adequately interpret the microeconomic concepts and apply the methods worked on in class, in limited time and without aid. By means of multiple-choice-questions, which are either embedded in a context/case/scenario or require prior computation, students' capacity to apply the learned solution strategies to new settings and draw correct economic implications is assessed.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
This course provides an introduction to basic concepts of microeconomics. It deals with the behaviour of individual economic units, such as households, business firms, and public institutions. Another concern is how these units interact to form markets and industries. How can consumer decisions be explained and how can aggregate demand be derived from consumer choice? Which are the factors that determine the production decisions of companies? How do equilibrium prices emerge in competitive markets, how in monopoly markets? What is the effect of government interventions in markets (e.g. taxes, price controls)? How does market power affect social welfare? Which factors lead to market failure?

Intended Learning Outcomes:
After attending this module, students will be able to describe economic tradeoffs (particularly in choice under scarcity situations of consumers and firms). Moreover, they know strategies to solve those tradeoffs and are capable of applying them to new situations. Students are able to explain the fundamental economic mechanisms underlying specialisation and trade (particularly in view of technological progress). Students can predict how government interventions (e.g. taxes, price controls) will affect simple competitive markets. They are able to explain why certain industries are prone to market concentration and how market power affects social welfare. They can distinguish which types of goods are efficiently provided on free markets, and which not.

Teaching and Learning Methods:
An interactive lecture introduces essential microeconomic concepts and theories and illustrates them with the help of topical empirical examples. Classroom experiments complement the classic bird-eye's perspective by nudging students to put themselves in the position of particular economic players, thereby requiring them to actively reflect the concepts introduced. Online surveys at the end of each chapter enable students to select which topics they would like to intensify in subsequent classes. In the accompanying exercise class, students practice, on specific
problems and examples, the mathematical techniques needed to develop a deeper understanding of the economic concepts. In self-study students use the textbook to repeat the concepts introduced in class and apply them to additional examples.

This module is also offered at TUM Campus Straubing.

**Media:**
Textbook, slides, exercise sheets, classroom experiments, online surveys

**Reading List:**

**Responsible for Module:**
Kurschilgen, Michael; Prof. Dr. rer. pol.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Economics I (Microeconomics) (WI000021) at Campus Straubing (lecture, 2 SWS)
Goerg S

Tutorial Economics I (Microeconomics) (WI000021) at Campus Straubing (exercise, 2 SWS)
Goerg S

Tutorial Economics I (Microeconomics) (WI000021) at Campus Straubing (exercise, 2 SWS)
Goerg S

Economics I (Microeconomics) (WI000021) at Campus Straubing (lecture, 2 SWS)
Goerg S

For further information in this module, please click [campus.tum.de](http://campus.tum.de) or [here](http://campus.tum.de).
Module Description

WI000021_E: Economics I - Microeconomics [VWL 1]

Microeconomics
TUM School of Management

Module Level: Bachelor
Language: English
Duration: one semester
Frequency: winter semester

Credits:* Total Hours: Self-study Hours: Contact Hours:
6 180 120 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
In the exam (written, 120 minutes) students should demonstrate their ability to adequately interpret the microeconomic concepts and apply the methods worked on in class, in limited time and without aid. By means of multiple-choice-questions, which are either embedded in a context/case/scenario or require prior computation, students' capacity to apply the learned solution strategies to new settings and draw correct economic implications is assessed.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
This module provides an introduction to basic concepts of microeconomics. It deals with the behaviour of individual economic units, such as households, business firms, and public institutions. Another concern is how these units interact to form markets and industries. How can consumer decisions be explained and how can aggregate demand be derived from consumer choice? Which are the factors that determine the production decisions of companies? How do equilibrium prices emerge in competitive markets, how in monopoly markets? What is the effect of government interventions in markets (e.g. taxes, price controls)? How does market power affect social welfare? Which factors lead to market failure?

Intended Learning Outcomes:
After attending this module, students will be able to describe economic tradeoffs (particularly in choice under scarcity situations of consumers and firms). Moreover, they know strategies to solve those tradeoffs and are capable of applying them to new situations. Students are able to explain the fundamental economic mechanisms underlying specialisation and trade (particularly in view of technological progress). Students can predict how government interventions (e.g. taxes, price controls) will affect simple competitive markets. They are able to explain why certain industries are prone to market concentration and how market power affects social welfare. They can distinguish which types of goods are efficiently provided on free markets, and which not.

Teaching and Learning Methods:
An interactive lecture introduces essential microeconomic concepts and theories and illustrates them with the help of topical empirical examples. Classroom experiments complement the classic bird-eye's perspective by nudging students to put themselves in the position of particular economic players, thereby requiring them to actively reflect the concepts introduced. Online surveys at the end of each chapter enable students to select which topics they would like to intensify in subsequent classes. In the accompanying exercise class, students practice, on specific
problems and examples, the mathematical techniques needed to develop a deeper understanding of the economic concepts. In self-study students use the textbook to repeat the concepts introduced in class and apply them to additional examples.

**Media:**
Textbook, slides, exercise sheets, classroom experiments, online surveys

**Reading List:**

**Responsible for Module:**
Kurschilgen, Michael; Prof. Dr. rer. pol.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Economics I (WI000021_E): (BSc English Track) (lecture, 2 SWS)  
Kurschilgen M (Strobel M)

Economics I Exercise - English (exercise, 2 SWS)  
Mukherjee A

For further information in this module, please click [campus.tum.de](http://campus.tum.de) or [here](http://campus.tum.de).
Module Description

MA9711: Mathematics in Natural and Economic Science 1  [MBNW 1]

Mathematik I
TUM School of Management

<table>
<thead>
<tr>
<th>Module Level:</th>
<th>Language:</th>
<th>Duration:</th>
<th>Frequency:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor</td>
<td>English</td>
<td>one semester</td>
<td>winter semester</td>
</tr>
<tr>
<td>Credits:*</td>
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</tr>
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<td>120</td>
<td>60</td>
</tr>
</tbody>
</table>

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The module examination is based on a written exam (90 minutes). Students have to show their knowledge of basic concepts of linear algebra and analysis and can adequately apply them in example problems of natural and economic sciences.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
none

Content:
Linear Algebra (vectors, matrices, subspaces, linear systems of equations, analytical geometry, determinants), sequences (linear recursions, limits, series), real functions (definition, polynomials, exponential functions, trigonometric functions, logarithms, power functions, limits and continuity), calculus (difference quotient, derivative, rules for computing derivatives, higher derivatives, shape of a graph, optimization, Taylor series), integral calculus (definite integral, computation of areas, antiderivative, fundamental theorem, rules for integration, applications), calculus of several variables (functions of several variables, partial derivatives, gradient, Hessian, maxima and minima with and without constraints), brief introduction to game theory (strategic game, Nash equilibrium)

Intended Learning Outcomes:
After attending this module students are aware of fundamental mathematical structures and methods. Students are able to understand the basic concepts of Linear Algebra (vectors, matrices, subspaces, linear systems of equations, analytical geometry, determinants) and Calculus (for example: real functions, integral calculus, and calculus of several variables) and to apply them to problems in science and economics.

Teaching and Learning Methods:
The module consists of a series of lectures. In the lectures, theoretical principles and examples are presented. In the optional exercise sessions, problems which illustrate and deepen the topics of the lectures are discussed. Optionally, additional exercise classes can be offered in which students work on problems, either independently or guided by mentors, and preferably in teamwork.

Media:
Following media are used:
- presentations
- assignments including solutions as download

**Reading List:**

**Responsible for Module:**
Schulz, Andreas; Prof. Dr. rer. nat.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Mathematics for Science and Economics 1 (lecture, 4 SWS)
Gritzmann P, Ritter M

Mathematics for Science and Engineering 1 (Central Exercise Session) (exercise, 2 SWS)
Gritzmann P, Ritter M

Mathematics for Science and Economics 1 (Additional Exercise Session) (exercise, 2 SWS)
Gritzmann P, Ritter M

For further information in this module, please click campus.tum.de or here.
Module Description

MA9712: Statistics for Business Administration

TUM School of Management

<table>
<thead>
<tr>
<th>Module Level:</th>
<th>Language:</th>
<th>Duration:</th>
<th>Frequency:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor</td>
<td>English</td>
<td>one semester</td>
<td>summer semester</td>
</tr>
<tr>
<td>Credits:*</td>
<td>Total Hours:</td>
<td>Self-study Hours:</td>
<td>Contact Hours:</td>
</tr>
<tr>
<td>6</td>
<td>180</td>
<td>120</td>
<td>60</td>
</tr>
</tbody>
</table>

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The module examination is based on a written exam (90 minutes). Students have to know basic terms and concepts of statistics and probability calculus and can choose appropriate statistical evaluation methods. They are able to understand and adequately interpret the given R Output.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
MA9711 Mathematics in Natural and Economic Science 1

Content:
Descriptive statistics:
- measures of location and variation
- graphical representation of uni- and bivariate data
- measures of association for bivariate data
- descriptive linear regression

Probability calculus:
- examples of discrete and continuous probability distributions
- conditional probabilities
- stochastic independence
- random variables and their distribution functions and moments
- conditional distributions

Statistical inference:
- confidence intervals
- hypothesis tests
- basic ideas of multiple linear regression

Introduction to the statistical software package R and guidance on how to perform simple statistical analyses in R.

Intended Learning Outcomes:
At the end of the module students are able to apply the basic methods of descriptive statistics and statistical inference and can draw correct conclusions from the results of these statistics. Further they know how to apply the basic methods of probability calculus. The students also know how to perform in R the basic statistical methods introduced in the module. They should also be aware of the capabilities and the limitations of the statistical
methods introduced in the lecture.

Teaching and Learning Methods:
The module consists of a series of lectures supplemented by exercise sessions. In the lectures, theoretical principles and examples are presented. In the exercise sessions, problems which illustrate and deepen the topics of the lectures are discussed. Optionally, additional exercise classes can be offered in which students work on problems, either independently or guided by mentors, and preferably in teamwork. Between classes the students will be supported in their self-study through a discussion forum.

Media:
e-learning (Moodle), lecture notes, exercise sheets, using a whiteboard app

Reading List:

Responsible for Module:
Czado, Claudia; Prof. Ph.D.

Courses (Type of course, Weekly hours per semester), Instructor:
3V + 1Ü

For further information in this module, please click campus.tum.de or here.
Module Description

WI000275_E: Management Science [MS]

TUM School of Management

Module Level: Bachelor  
Language: German/English  
Duration: one semester  
Frequency: winter semester

Credits:*  
Total Hours: 180  
Self-study Hours: 120  
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Students mastery of the content taught in this module is checked with a 60 minutes written exam. Students are only allowed to use a non-programmable calculator. In the exam students have to answer questions, apply algorithms to solve problems, create mathematical models for small example problems, and discuss presented results. By this the students have to demonstrate that they have understood and can apply the mathematical models and methods to solve business planning problems. The overall grade of the module is based on the result obtained in the written exam.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Knowledge of Mathematics and Statistics at the level as defined in the German Abitur

Content:
Management Science is about modeling, solving and analyzing planning and decision problems using mathematical concepts. Management Science is used across different industries, departments and organizations. The lecture will treat the Management Science approach to decision making in general and the following topics in particular: Linear Programming, Mixed-Integer Programming, Graph Theory, Network Flow, Dynamic Programming and Decision Theory.

Intended Learning Outcomes:
After successful completion of the module students are capable of modelling planning problems. They are able to solve small business problems manually by using models and methods of linear and horizontal programming, of graph theory, of network flow, of dynamic programming, and of decision theory.

Teaching and Learning Methods:
The module consists of a lecture and exercise courses, which are provided weekly, as well as a voluntary tutorial offered biweekly. In the lecture the content is jointly developed with the students mainly by using slides. The exercise course repeats parts of the lecture contents by using examples. The tutorials are delivered by student teaching assistants for groups of up to 20 students which gives the student the opportunity to pose questions and receive immediately help from the teaching assistant.

This module is also offered at TUM Campus Straubing.
Reading List:

Responsibilities for Module:
Kolisch, Rainer; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Management Science (WI000275_E) (lecture, 2 SWS)
Kolisch R

Management Science (WI000275_E) at Campus Straubing (lecture, 2 SWS)
Ostermeier M, Roth B

Management Science Exercises (WI000275_E) at Campus Straubing (exercise, 2 SWS)
Ostermeier M, Roth B

Management Science Exercises (WI000275_E) (exercise, 2 SWS)
Weber H

For further information in this module, please click campus.tum.de or here.
Basics in Management
Financial Accounting and Reporting
Module Description

WI001059: Financial Accounting and Reporting

TUM School of Management

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<th>Language:</th>
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<td>Bachelor</td>
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<td>one semester</td>
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<td>180</td>
<td>120</td>
<td>60</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The examination of the students success consists of a written exam (120 min, multiple choice). Students may use a non-programmable calculator and a Handelsgesetzbuch (HGB) without additional notes as helping material. In the exam students show that they are able to correctly conduct individual financial statements, understand consolidated financial statements and apply consolidation principles as well as understand and apply balance sheet policy and analysis. This is done by means of conducting consolidations, and by solving arithmetic problems as well as theoretical problems regarding financial statements. Students can take part in a re-examination exam in the next semester. In case of a limited number of participants in such a re-examination exam it might be substituted by an oral examination (15 minutes) with equal content.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
The module gives an overview over basic financial accounting, focusing on regulations regarding commercial accounting in individual and consolidated financial statements.

In the first part of the module basic principles of financial accounting are introduced, dealing with general economic accounting and special financial accounting.

In the second part individual financial statements in terms of commercial law are explained and regulations for annual accounts and annual reports are discussed in detail.

The third part deals with consolidated financial statements and consolidation principles as well as corresponding postings in accounting.

In the fourth part of the module fundamentals of balance sheet policy and analysis are discussed.

Intended Learning Outcomes:
Upon successful completion of this module, students are able to understand the construction of individual and consolidated financial statements on grounds of the HGB and to apply the accounting regulations of the HGB practically. They can read and draw up balance sheets. Students are also able to evaluate which enterprises have to put up consolidated financial statements and which subsidiaries have to be included. Furthermore, they can independently carry out different consolidations correctly.
The module consists of a lecture and a corresponding tutorial, which is integrated into the lecture (lecture: 2 SWS; tutorial: 2 SWS). In the tutorial the content of the lecture and its understanding is deepened and extended by exercises and case studies. Relevant scripts and exercises can be downloaded via Moodle. The lectures content is conveyed by means of presentation, while in the tutorial parts students can practise how to apply theoretical concepts practically.

This module is also offered at TUM Campus Straubing.

**Teaching and Learning Methods:**
The module consists of a lecture and a corresponding tutorial, which is integrated into the lecture (lecture: 2 SWS; tutorial: 2 SWS). In the tutorial the content of the lecture and its understanding is deepened and extended by exercises and case studies. Relevant scripts and exercises can be downloaded via Moodle. The lectures content is conveyed by means of presentation, while in the tutorial parts students can practise how to apply theoretical concepts practically.

**Media:**
Script, tutorials, case studies, moodle

**Reading List:**

Meyer, Klaus: Bilanzierung nach Handels- und Steuerrecht, 22. Auflage, Herne 201

**Responsible for Module:**
Prof. Dr. Jürgen Ernstberger

**Courses (Type of course, Weekly hours per semester), Instructor:**
Financial Accounting and Reporting (WI001059) (lecture with integrated exercises, 4 SWS)
Grottel B, Keiling M

Financial Accounting and Reporting Exercise (WI001059) at Campus Straubing (exercise, 2 SWS)
Maniora J [L], Hertl I, Maniora J

Financial Accounting and Reporting (WI001059) at Campus Straubing (lecture, 2 SWS)
Maniora J [L], Hertl I, Maniora J

For further information in this module, please click campus.tum.de or here.
Module Description

WI001059_E: Financial Accounting

TUM School of Management

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<th>Module Level:</th>
<th>Language:</th>
<th>Duration:</th>
<th>Frequency:</th>
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<tbody>
<tr>
<td>Bachelor</td>
<td>English</td>
<td>one semester</td>
<td>winter semester</td>
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Credits:*  Total Hours:  Self-study Hours:  Contact Hours:
6  180  120  60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The examination of the students' success consists of a written exam (120 min, multiple choice). If the number of participants is low, it is also possible to substitute the written exam by an oral exam (15 min). Students may use a non-programmable calculator and International Financial Reporting Standards as helping material. In the exam students show that they are able to correctly conduct individual financial statements, understand consolidated financial statements and apply consolidation principles as well as understand and apply balance sheet policy and analysis. This is done by means of conducting consolidations, and by solving arithmetic problems as well as theoretical problems regarding financial statements.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
The course gives an overview over basic financial accounting according to International Financial Reporting Standards (IFRS), focussing on regulations regarding commercial accounting in individual and consolidated financial statements.
In the first part of the lecture basic principles of financial accounting are introduced, dealing with general economic accounting and special financial accounting.
In the second part individual financial statements are explained and regulations for annual accounts and annual reports are discussed in detail.
In the third part methods of financial statement analysis are introduced and discussed.

Intended Learning Outcomes:
Upon successful completion of this module, students are able to understand the construction of individual and consolidated financial statements according to International Financial Reporting Standards (IFRS) and to apply the accounting regulations of the IFRS practically.
Students are also able to evaluate which enterprises have to prepare consolidated financial statements and which subsidiaries have to be included. Furthermore, they can independently carry out different consolidations correctly.

Teaching and Learning Methods:
The course consists of a lecture and a corresponding tutorial, which is integrated into the lecture. In the tutorial the content of the lecture and its understanding is deepened and extended by exercises and case studies. Relevant scripts and exercises can be downloaded via Moodle.
The lectures content is conveyed by means of presentation, while in the tutorial parts students can practise how to
apply theoretical concepts practically.

Media:
Script, tutorials, case studies, moodle

Reading List:
Internationale Rechnungslegung (Pellens/Fülbier/Gassen/Sellhorn)

Responsible for Module:
Ernstberger, Jürgen; Prof. Dr. rer. pol. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Financial Accounting (WI001059_E): (BSc Engl. Track) (lecture with integrated exercises, 4 SWS)
Ernstberger J, Grottel B, Keiling M

For further information in this module, please click campus.tum.de or here.
Cost Accounting
Module Description

WI001057: Cost Accounting

TUM School of Management

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<th>Module Level:</th>
<th>Language:</th>
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<td>180</td>
<td>120</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The grading is based on a written exam (60 minutes). Students are allowed to use a non-programmable calculator for the exam. The students answer questions about definitions of cost accounting and about the basic principles of cost accounting. They further answer theoretical questions about concepts of cost accounting and their application. In a second part of the exam they have to apply the concepts to exemplary problems of cost accounting and are asked to perform the methods of cost accounting. Finally, they answer questions about the interpretation of their results.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
The course introduces students to managerial cost accounting. These are:
- cost type accounting (especially the different techniques to register the cost types of material and personnel costs)
- the assignment and allocation of indirect costs to the various cost centers
- the assignment of the determined costs to the individual products by using different techniques of product costing
- calculations of the operating result of the period
- systems of managerial cost accounting (cost planning and cost analysis)
- break even analysis

Intended Learning Outcomes:
After having attended this module, students will be able to remember and understand the basic concepts of managerial cost accounting systems. They will be able to analyze accounting problems and identify solutions. They will also be able to explain how managerial cost accounting support decision-making in a company. They will be able to apply the newly acquired knowledge to solve real-world accounting problems. They will be able to compare different concepts of managerial cost accounting such as variable vs absorption costing.

Teaching and Learning Methods:
The course consists of a lecture and a tutorial. During the lectures the contents are delivered by presentations and discussions. The students are inspired to improve the acquired knowledge by studying the suggested literature. In the tutorials the students apply the acquired knowledge in solving exercises and implementing case studies.
This module is also offered at TUM Campus Straubing.

**Media:**
presentations, text books, script, exercises

**Reading List:**

**Responsible for Module:**
Friedl, Gunther; Prof. Dr.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Cost Accounting - Exercise (WI001057) (Bachelor TUM-BWL) (exercise, 2 SWS)  
Friedl G [L], Gamarra Y, Holzmann J

Cost Accounting (WI001057) (Bachelor TUM-BWL) at Campus Straubing (lecture, 2 SWS)  
Maniora J [L], Maniora J

For further information in this module, please click campus.tum.de or here.
Module Description

WI001057_E: Cost Accounting

TUM School of Management

Module Level: Bachelor
Language: English
Credits:* 6
Total Hours: 180
Self-study Hours: 120
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The grading is based on a written exam (60 minutes). Students are allowed to use a non-programmable calculator for the exam. The students answer questions about definitions of cost accounting and about the basic principles of cost accounting. They further answer theoretical questions about concepts of cost accounting and their application. In a second part of the exam they have to apply the concepts to exemplary problems of cost accounting and are asked to perform the methods of cost accounting. Finally, they answer questions about the interpretation of their results.

Repeat Examination: Next semester

(Recommended) Prerequisites:
None

Content:
The course introduces students to managerial cost accounting.
These are:
- cost type accounting (especially the different techniques to register the cost types of material and personnel costs)
- the assignment and allocation of indirect costs to the various cost centers
- the assignment of the determined costs to the individual products by using different techniques of product costing
- calculations of the operating result of the period
- systems of managerial cost accounting (cost planning and cost analysis)
- break even analysis

Intended Learning Outcomes:
After having attended this module, students will be able to remember and understand the basic concepts of managerial cost accounting systems. They will be able to analyze accounting problems and identify solutions. They will also be able to explain how managerial cost accounting support decision-making in a company. They will be able to apply the newly acquired knowledge to solve real-world accounting problems. They will be able to compare different concepts of managerial cost accounting such as variable vs absorption costing.

Teaching and Learning Methods:
The course consists of a lecture and an exercise. During the lectures the contents are delivered by presentations and discussions. The students are inspired to improve the acquired knowledge by studying the suggested literature. In the exercises the students apply the acquired knowledge in solving problem sets and implementing case studies.
Media:
presentations, text books, lecture notes, exercises

Reading List:

Responsible for Module:
Friedl, Gunther; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Cost Accounting (WI001057_E) (Bachelor TUM-BWL) (lecture, 2 SWS)
Friedl G [L], Blaschke M

Cost Accounting - Exercise (WI001057_E) (Bachelor TUM-BWL) (exercise, 2 SWS)
Friedl G [L], Delic A

For further information in this module, please click campus.tum.de or here.
Investment and Financial Management
Module Description

WI000219: Investment and Financial Management

TUM School of Management

Module Level: Bachelor  
Language: German  
Duration: one semester  
Frequency: winter semester

Credits:*  
Total Hours: 180  
Self-study Hours: 120  
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The grading is based on a written exam with a duration of 120 minutes. To test whether the students acquired the theoretical basics in financial analysis and investment planning, multiple choice questions are asked, where they have to find the correct or incorrect statement among several alternative statements. By using a calculator and the formulary issued by the chair, the students for example have to analyse investment projects, create the optimal capital structure of projects or firms, evaluate bonds, stocks, or equity options.

Repeat Examination:  
Next semester

(Recommended) Prerequisites:  
none

Content:
The module will give students a broad understanding of the instruments to analyse and evaluate investment opportunities. Subsequent, a complete list of these methods:

- Financial Statement Analysis (balance sheet analysis, analysis of profit and loss account)
- Investment Analysis (net present value method, actuarial return)
- Capital Budgeting (determination of free cashflows, choosing between alternatives)
- Cost of Capital (equity costs, borrowing costs, capital costs)
- Capital Structure

Intended Learning Outcomes:
Upon completion of this module students will be able to: (1) to name and apply important measures of company performance, (2) to analyze and choose investment projects, (3) to create the optimal capital structure of projects and firms, (4) restate and employ concepts of financial mathematics and (5) to evaluate financial instruments.

Teaching and Learning Methods:
The module will combine several teaching methods.

- Weekly Lecture: Presentation of theoretical basics and applied examples, supported by slides. As a better learning effect is reached by a dynamic learning environment, the student can join in live surveys with onlineTED.
- Exercise available on several dates: Calculation of selected exercises from the set of exercises in small groups so the students can directly ask questions about the calculations.
- Set of exercises with applied examples for individual practising of exercises.

This module is also offered at TUM Campus Straubing.
Media:
Presentations, exercises with solutions, online TED

Reading List:

Responsible for Module:
Kaserer, Christoph; Prof. Dr. rer. pol. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Investment and Financial Management: Introduction to Corporate Finance (WI000219) (exercise, 2 SWS)
Kaserer C (Knauer L)

Investment and Financial Management: Introduction to Corporate Finance (WI000219) (lecture, 2 SWS)
Kaserer C (Knauer L)

Investment and Financial Management (WI000219) (lecture, 2 SWS)
Maniora J [L], Hertl I, Maniora J

Investment and Financial Management - Exercise (WI000219) at Campus Straubing (exercise, 2 SWS)
Maniora J [L], Hertl I, Maniora J

For further information in this module, please click campus.tum.de or here.
Module Description
WI000219_E: Investment and Financial Management

TUM School of Management

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<td>Bachelor</td>
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<td>180</td>
<td>120</td>
<td>60</td>
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</table>

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The grading is based on a written exam with a duration of 120 minutes. To test whether the students acquired the theoretical basics in financial analysis and investment planning, multiple choice questions are asked, where they have to find the correct or incorrect statement among several alternative statements. By using a calculator and the formulary issued by the chair, the students have to analyze investment projects, create the optimal capital structure of projects or firms, evaluate bonds, stocks, or equity options, and have to choose the right alternative from various possible answers as the exam is in form of multiple choice questions.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
none

Content:
The module will give students a broad understanding of the instruments to analyze and evaluate investment opportunities. Subsequent, a complete list of these methods:
- Financial Statement Analysis (balance sheet analysis, analysis of profit and loss account)
- Investment Analysis (net present value method, actuarial return)
- Capital Budgeting (determination of free cashflows, choosing between alternatives)
- Cost of Capital (equity costs, borrowing costs, capital costs)
- Capital Structure

Intended Learning Outcomes:
Upon completion of this module students will be able to: (1) to name and apply important measures of company performance, (2) to analyze and choose investment projects, (3) to create the optimal capital structure of projects and firms, (4) restate and employ concepts of financial mathematics and (5) to evaluate financial instruments.

Teaching and Learning Methods:
The module will combine several teaching methods.
- Weekly Lecture: Presentation of theoretical basics and applied examples, supported by slides. As a better learning effect is reached by a dynamic learning environment, the student can join in live surveys with onlineTED.
- Exercise available on several dates: Calculation of selected exercises from the set of exercises in small groups so the students can directly ask questions about the calculations.
- Set of exercises with applied examples for individual practicing of exercises.
Media:
Presentations, exercises with solutions, onlineTED

Reading List:

Responsible for Module:
Braun, Reiner; Prof. Dr. rer. oec.

Courses (Type of course, Weekly hours per semester), Instructor:
Investment and Financial Management: Introduction to Corporate Finance (WI000219_E) (lecture, 2 SWS)
Braun R [L], Jarchow-Pongratz S, Weik S

Investment and Financial Management: Introduction to Financial Markets (WI000219_E) (exercise, 2 SWS)
Braun R [L], Jarchow-Pongratz S, Weik S

For further information in this module, please click campus.tum.de or here.
Module Description

WI000261: Empirical Research Methods  [ERM]

TUM School of Management

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<td>Bachelor</td>
<td>German/English</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Exam
Grading is based on a 100% multiple-choice exam (120 minutes) with about 50-60 questions at the end of the lecture. The questions will be of different character and allow students to show that they have understood basic concepts of empirical research and that they can analyze and evaluate research design and research outputs on their empirical and conceptual accuracy.

Extra credit (Midterm assignment)
Accompanying this class, you will be able to participate in two types of work to earn extra credit toward your grade. This means that completing this work is not mandatory, and full marks can be achieved without participating. The first assignment is a teamwork task and focuses on the comprehension of a chosen scientific paper of the management literature. Each student has to write a short précis (1-2 pages). The second assignment is an individual task and is about the systematic creation and processing of a data set. The workload for this task is on average about 4-6 hours. Both extra assignments help to improve class performance and can improve the final grade. Participating successfully in these assignments may improve the final grade by 0.3.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Mathematics, Statistics

Content:
Understanding how research works is essential for any student and practitioner of management. All insights we draw on - may they come from teaching, research, or actual business activities - must meet a certain level of academic rigor to be trustworthy, and only trustworthy information should become a source of learning and a foundation of managerial decision making.

Topics:
- Research ethics
- Research question and their implications
- Paper reading, positioning, and contributions
- Correlation and causality
- Choosing a research design
- Qualitative research
- Quantitative analyses & quantitative research design
- Using existing scales and data
- Data preparation and descriptive statistics
- Advanced quants

**Intended Learning Outcomes:**

This module will give you an introduction to empirical research methods, including the higher aims of empirical research, the standards it needs to meet, and a set of methods that you can directly apply. By the end of the module, you will thus be able to understand the scientific process in general - and in the context of management studies in particular - and be able to evaluate whether a result or statement you are confronted with is indeed trustworthy. In doing so, not only will you become able to more critically evaluate everyday information (such as news items or pseudo-scientific studies) but you will also be prepared to participate in the scientific process yourself by improving your ability to read and understand academic work, and getting to know the steps you will need to take to make a contribution yourself, as you will be required to do in other parts of your study programs, such as in research seminars or your final thesis.

**Knowledge Objectives**

After the module students will be able to:
- understand the nature of the scientific process, in particular in the context of management studies
- explore different approaches toward solving (scientific) problems
- use and apply selected empirical research methods (e.g., for seminar of final theses)
- understand the structure and evaluate the quality of academic papers in management studies
- (in parts) create their own research projects

**Skills Objectives**

- improve diagnostic and analytical skills
- think creatively about how best to solve complex problems
- build up critical thinking as well as judgment and interpretation skills
- learn how to evaluate different strategic options
- work together efficiently and effectively in groups

**Learning Objectives**

At the end of this module, students will be able to demonstrate understanding, critical assessment and application of the following:
- assess (pseudo-)scientific work in general, and in particular in the context of management studies
- understand and evaluate potential approaches toward answering academic questions
- utilize tools and techniques of empirical research for their own future studies

**Teaching and Learning Methods:**

Lectures will be largely taught by an instructor based on a slide deck with some interactive elements. Exercises will feature a lower number of slides and largely build on class contributions. Exercises will actually take place in the computer pools (CIP) where you will be doing hands-on work.

In order to ensure you get most out of the module, we suggest you adhere to the principles that guide all our teaching:

**Have fun**

Our challenge is to make sure that you learn about the importance of empirical research methods and their relevance to and application in today's business environment. Importantly, even if you do not intend to embark on a career on an academic career, knowing about the research process and how it is executed well are essential pieces of knowledge for anyone in any industry. Thus, look at this class as an opportunity to acquire and sharpen a set of skills you will need in a couple of months/years when you might be working in a company, possible using or evaluating one of the methods explored in this very lecture!

**Attend and prepare for class**

While we understand that many of you will not be able to come to all sessions of this module, our hope and ambition is that you will try. Put differently, we promise to make the lectures interesting enough so that they are worth attending. Also, we will provide you with instructions as to how to prepare so that you can take the most out
of each lecture - at the very least, you should have looked at these in advance! Note how your preparation is essential for the exercises and labs, the success for which depends on your contributions.

Participate Actively
Despite this being a fairly large class, we will try to conduct this module in an interactive manner. The more actively you participate during class, the better you will be prepared for the exam and the more of this module you will remember for your work life. Thus, do not try to hide in a large crowd, but summon your courage, take a chance, and rise to the challenge of participating.

Design your own learning experience
At several places throughout this module, we will give you an opportunity to participate in the design and execution of this module. For example, over the module of the term, you will have the opportunity to contribute multiple choice question for each class, which everyone in the end can use to prepare for the exam.

Give feedback
Your feedback - in class or in private - on any aspect of this module is welcome at any time. It can help make this module an excellent experience for you and for us. We encourage you to comment on this module on Moodle and we will respond as quickly as possible. If you wish to see one of us in person, please let us know and schedule an appointment in advance so that we can prepare. Come prepared. I will also usually try to be available directly after the lecture.

This module is also offered at TUM Campus Straubing.

Media:
Powerpoint, Board, Videos, Flipchart, Debates

Reading List:
For each session, we will upload individual preparation sheets specifying what we recommend you to have done before class. These sheets will also contain information on reading materials that elaborate on what we cover in class. Everything specified as "mandatory" by these preparation sheets is also part of the subject matter for the exam. All mandatory readings will be provided when they cannot be easily accessed through the library resources available to you. Also note how everything we do in class is relevant to the exam - importantly, this includes all questions asked in class, irrespective of whether they are answered in class.

In case you want to do preparatory or additional reading on empirical research methods, we recommend the following textbooks (on which we will also draw to some degree for the lecture):

Responsible for Module:
Gäßler, Fabian; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:

WI000261: Empirical Research Methods [ERM]
For further information in this module, please click campus.tum.de or here.
Module Description

WI000820: Marketing and Innovation Management

TUM School of Management

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<th>Language:</th>
<th>Duration:</th>
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<td>Bachelor</td>
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<th>Self-study Hours:</th>
<th>Contact Hours:</th>
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<tr>
<td>6</td>
<td>180</td>
<td>120</td>
<td>60</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The grading will be based on a written exam (120 min). By answering multiple choice questions students have to show that they have understood and can apply models and concepts related to markets aspects of innovation and to the organization of the innovation process. The questions also assess whether students remember and understand marketing basics (including key terms, theories, frameworks, the use of marketing strategies and marketing mix instruments, and their interrelationship with core concepts in marketing). The questions may require calculations. Students may use a non-programmable calculator to do these calculations.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
Market aspects of innovation:
- Innovation: Examples and particularities,
- Innovation and the development of industries,
- Sources of innovation,
- Innovation strategy: Analysis of the market, technology and competition,
- Acquisition of technology: Market, cooperation and networks

Organizing the innovation process:
- The innovation process within the firm,
- R&D, production and marketing,
- Cooperation for innovation?
- Motivation and incentive systems,
- Promotors and champions,
- Roles in the innovation process,
- Opposition against innovation within the firm,
- Integrating customers into the innovation process,
- Measuring and controlling innovation.

Marketing management:
- Principles of marketing,
- Marketing strategy and environment,
- Creating customer value, satisfaction, and loyalty,
- Information management and market research,
- Analyzing consumer and business markets,
- Competition and differentiation from competitors,
- Segmenting, targeting, and positioning,
- Creating and managing products and services, brand management,
- Pricing,
- Marketing communications, marketing channels, and service P's.

**Intended Learning Outcomes:**
At the end of the module, students will be able to (1) recognize and apply models and concepts related to the market aspects of innovation (e.g., modes of acquisition of technology) and to the organization of the innovation process (e.g., promoters and champions in the innovation process), (2) identify how they can be concretely used in companies, (3) remember and understand the key terms used in marketing, (4) explain common marketing theories and frameworks, (5) describe and justify the use of both marketing strategies and marketing mix instruments, and (6) relate the strategies and use of instruments to core concepts in marketing, such as customer lifetime value, segmenting, targeting, and positioning, decision making styles, customer-perceived value, satisfaction, and loyalty, as well as branding.

**Teaching and Learning Methods:**
The module consists of two lectures including one or two sessions held by guest speakers to refer to state of the art examples of marketing and innovation. Students will be motivated to read the literature before and after each lecture and relate it to the content taught in class. Furthermore, they will be motivated to discuss the content in online forums that are made available to the students.

This module is also offered at TUM Campus Straubing.

**Media:**
Lecture slides are available via Moodle. Presentation slides, online discussion forum

**Reading List:**
- Afuah - Innovation Management. strategies, implementation, and profits
- Dodgson, Gann, Salter - The Management of Technological Innovation (Chapter 4)
- Teece - Profiting from Technological Innovation: Implications for integration, collaboration, licensing and public policy
- Stamm - Structured Processes for Developing New Products
- Hauschildt, Kirchmann - Teamwork for innovation - the "troika" of promoters

**Responsible for Module:**
Henkel, Joachim; Prof. Dr. rer. pol.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Technology and Innovation Management: Introduction (WI000820) (lecture, 2 SWS)
Doblinger C [L], Doblinger C

Technology and Innovation Management: Introduction (WI000820) (lecture, 2 SWS)
Doblinger C [L], Doblinger C
Marketing (WI000688, WI000820) (lecture, 2 SWS)
Menrad K [L], Menrad K
Marketing (WI000688, WI000820) (lecture, 2 SWS)
Menrad K [L], Menrad K

For further information in this module, please click campus.tum.de or here.
Module Description

WI001058: Foundations of Entrepreneurial & Ethical Business

TUM School of Management

<table>
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<th>Module Level:</th>
<th>Language:</th>
<th>Duration:</th>
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<td>one semester</td>
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<td>180</td>
<td>120</td>
<td>60</td>
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</table>

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The grading is based on a written exam (120 Minutes). The written form of the exam allows a comprehensive assessment of students' knowledge and understanding of the basic principles of entrepreneurship. They will answer questions about the concepts explaining the mindset of entrepreneurial individuals and the management of entrepreneurial firms as introduced in the lecture. They will also answer questions about basic definitions of specific types of entrepreneurship and entrepreneurial behavior. The exams allows for a comprehensive evaluation of students' knowledge of basic principals and models of business ethics and their ability to further develop their knowledge of entrepreneurship. Students will answer questions about basic definitions and theories of ethical behavior and decision making, and they will assess ethical behavior in the business context.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
The module introduces students into basic principles of the topic of entrepreneurship from a global and international perspective. Students will be equipped with basic knowledge on:
- definitions, regional aspects, and special forms of entrepreneurship
- entrepreneurial individuals, including their personality, creativity, idea development, cognition, opportunity recognition, decision making, affect, and moving forward from failure
- entrepreneurial firms, including their growth strategies, strategic alliances, and resources.

Beyond that, students will engage in break-out group workshops to personally experience the process of opportunity recognition and development. In these workshops they will work in teams and apply concepts from academic literature to real-world entrepreneurial problems. Furthermore, students give presentations to the audience and discuss their results.

In addition, the module introduces basic problems, arguments, and theoretical approaches of business ethics. It investigates the chances of realizing moral norms at the interception of entrepreneurship/economics and ethics. Basic is the analysis of ethical decision processes in corporations and the detailed investigation of situations and alternatives of action. Topics involve reputation, trust and social capital as well es corruption, environmental protection, and global ethical concepts. This part ends with a critical discussion of different research approaches in the debate on business ethics.

Intended Learning Outcomes:
First, students will know and be able to explain basic concepts of entrepreneurship including basic definitions, psychological processes and characteristics of the person of the entrepreneur, and potential development paths of young firms. Further, students will transfer this basic knowledge to real world cases. Thus, students will be able to
solve entrepreneurial problems in real world settings drawing on theoretical frameworks of the entrepreneurial process.

Students will be able to understand the ethical meaning of economic theories, reflect on ethical matters in business, and apply ethical theories in entrepreneurship and business settings. Thus, students will be able to decide in ethical manners in entrepreneurial and business life drawing on established ethical theories and concepts.

**Teaching and Learning Methods:**
The module will combine several learning methods.
- The basic knowledge as well as real world examples will be provided through the lecture.
- Discussions in the lecture and active participation are encouraged and will contribute to deepen the understanding of the concepts introduced.
- Workshops in smaller groups enable the students to apply (part of) their theoretical knowledge to real-world problems. This format additionally fosters creativity and team work.
- Students will get additional background knowledge from the scientific literature in private reading.

The module is also offered at TUM Campus Straubing.

**Media:**
Presentations, exercises, online materials

**Reading List:**
Karl Homann/Franz Blome-Drees: Wirtschafts- und Unternehmensethik, Göttingen 1992

**Responsible for Module:**
Patzelt, Holger; Prof. Dr. rer. pol.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Introduction to Entrepreneurship (WI001058, WI101058) (Part I of Module "Foundations of Entrepreneurial and Ethical Business") at Campus Straubing (lecture, 2 SWS)
Doblinger C

Introduction to Business Ethics (WI001058, WI101058) (Part II of Module "Foundations of Entrepreneurial and Ethical Business") at Campus Straubing (lecture, 2 SWS)
Doblinger C

(WI001058) Introduction to Business Ethics (Part II of Module "Foundations of Entrepreneurial and Ethical Business") (lecture, 2 SWS)
Lütge C [L], Max R, Uhl M

Introduction to Entrepreneurship (WI001058) (Part II of Module "Foundations of Entrepreneurial and Ethical Business") (lecture, 2 SWS)
Preller R [L], Preller R
For further information in this module, please click campus.tum.de or here.
Module Description

WI001060: Production and Logistics

TUM School of Management

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<td>one semester</td>
<td>summer semester</td>
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<tr>
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<td>120</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The examination of the module consists of an exam (written, 120 minutes). Allowed aid is a non-programmable calculator.

In the exam students show that they can apply different approaches to problem solving - based on the understanding of the production and logistics planning in general. By means of exemplary objects from the production or logistics planning the students demonstrate that they can interpret planning problems and connections between different problems. Based on this knowledge students give recommendations to tackle the problems.

Repeat Examination:  
Next semester

(Recommended) Prerequisites:
None

Content:
This is an introductory module, providing an overview on planning problems in production and logistics and on methods to solve these. Students become acquainted with different planning hierarchies (strategic, tactical and operational) and the planning problems on the respective level. In order to deal with the arising decision problems in production and logistics simple heuristics as well as simple linear programming and mixed integer programming models are discussed and applied.

Contents are:
- strategic planning problems such as site location planning
- tactical planning level: infrastructure of production systems
- operational planning decisions: demand forecasting techniques and examine master planning problems.
- material requirements planning
- production planning: lot sizing questions, machine scheduling and sequencing in flow lines
- transport logistics: planning problems on the determination of tours, routes and packing schemes
- material logistics: inventory control policies and their extension to the stochastic case are elaborated
- strategic design of the logistics network
- interfaces to the predecessor resp. successor companies
- procurement stage: methods for the selection of suppliers
- distribution stage: installment of a suitable distribution network and the processes in the warehouse
Intended Learning Outcomes:
After participating in this introductory module, students will be able to
- understand the relation between different planning problems in production and logistics
- analyse specific planning problems of the strategic, tactical and operational level (for details see course content), as well as on how to apply respective solution approaches
- explain essential managerial tasks in production and logistics planning
- evaluate the economic impact of production and logistics related decisions (e.g. the tradeoff between holding and setup costs or between costs and service)

Teaching and Learning Methods:
The learning methods consist of lectures, (voluntary) tutorials and further literature.
The lectures are used to convey the theoretical foundation and include conducting exercises.
The tutorials accompany the lectures and deepen their content in an environment of small student groups.
Students solve exercises on their own for most of the time and sometimes in group work.
During the lecture, further readings are suggested, to get a deeper understanding of the course content.

This module is also offered at TUM Campus Straubing.

Media:
Presentations, Script (Produktionsmanagement)

Reading List:

Responsible for Module:
Minner, Stefan; Prof. Dr. rer. pol.

Courses (Type of course, Weekly hours per semester), Instructor:
Production Management (WI000800, WI001060) (lecture, 2 SWS)
Grunow M [L], Grunow M ( Pahr A )

Logistics and Supply Chain Management (WI001060) (lecture, 2 SWS)
Rogetzer P, Svoboda J

For further information in this module, please click campus.tum.de or here.
Module Description

WI001121: Strategic and International Management & Organizational Behavior

TUM School of Management

Module Level: Bachelor
Language: German/English
Duration: one semester
Frequency: winter semester
Credits:* 6
Total Hours: 60
Self-study Hours: 180
Contact Hours: 120

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Grading is based on the performance in a 120min written examination. The examination consists of single-choice-questions, which aim at testing knowledge on different levels: Knowledge questions aim at the recall of the learned concepts, e.g. by reproducing different change management models; decision items aim at classifying or interpreting the module contents, e.g. by contrasting and comparative analysis of different strategies of multinational enterprises; application and scenario questions aim at testing the ability to transfer the learned concepts to real-life settings, e.g. by identifying solutions to short practical cases in conflict management. It is allowed to bring one hard-copy dictionary (English ¿ first language) or English thesaurus. Furthermore, no aids such as lecture slides, personal notes, etc. are allowed.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basics of business administration

Content:
According to the intended learning outcomes of this module, the lectures cover the most important theories and methods of strategic and international management and organizational psychology. In the course of the increasing globalization, companies of almost all industries and sizes have to include an international dimension in their strategic considerations. Strategic and international management skills are important for formulating and implementing competitive strategies. Therefore, the module puts special emphasis on strategic and international management topics. Furthermore, basic approaches and models of work and organizational psychology are presented. They serve to understand behavior on the individual, team, and organizational level of business organizations. In detail, the module will focus on theoretical explanations and practical implications of the following contents:
- Fundamental principles of leadership;
- fundamentals and characteristics of strategic and international management;
- general conditions of strategic and international management;
- effects of individual personality characteristics and motivation in organizations;
- ethical behavior in organizations;
- team structures and processes;
- change management in national and international organizations;
- theories and strategies of multinational enterprises;
- international dimension of certain functional areas of business;
- national and international organizational culture.
Intended Learning Outcomes:
Upon successful completion of this module, students are able to reproduce basic knowledge of strategic and international management and organizational behavior. Moreover, students can recall, understand, and explain basic concepts of strategic and international management and organizational behavior. They can apply their knowledge to practical problems and challenges. Furthermore, students are able to explain theories, models, and methods related to strategic and international management and organizational behavior. In addition, students are able to identify and analyze challenges and problems related to strategy and management, motivation, teamwork, decision making, and communication in business organizations, especially in multinational enterprises. Finally, they are able to outline practical solutions to strategy and management challenges, conflict management, organizational change, and ethical issues by applying the acquired theoretical concepts.

Teaching and Learning Methods:
In the interactive as well as online video-based lectures, the most important concepts, approaches, theories, and empirical studies in the field of strategic and international management and organizational behavior are introduced and discussed. Practical examples and case studies serve to illustrate the relevant theories and methods. Moreover, students are encouraged to engage in individual exercises and/or small group assignments during the lectures as well as video analyses in order to look deeper into the course contents and to support transfer of the acquired theories and methods. Finally, the self-study of literature is part of the module.

This module is also offered at TUM Campus Straubing.

As part of the module, students are able to participate in two 60-120 min long psychological studies/psychological experiments as a mid-term examination. Participation is voluntary and can, in accordance to APSO regulations, be used to improve the grade on the final exam. This mid-term examination illustrates parts of the learning content and allows students to gain experience with scientific (psychological) methodology. Available experiments are listed on http://motivatum.wi.tum.de/EN/.

Media:
Slides (download)
Online video lectures (download)
if applicable, present scientific international literature (English)
if applicable, case studies

Reading List:
Hill, C.W.L. (2014), International business: Competing in the Global Marketplace

Responsible for Module:
Kehr, Hugo; Prof. Dr. phil.

Courses (Type of course, Weekly hours per semester), Instructor:
Organizational Behavior (WI001121) (lecture, 2 SWS)
Bakac C, Kehr H

Strategic and International Management (WI001121) (Bachelor TUM-BWL) at Campus Straubing (lecture, 2 SWS)
Doblinger C

Organizational Behavior (WI001121) at Campus Straubing (lecture, 2 SWS)
Goerg S

Strategic and International Management (WI001121) (Bachelor TUM-BWL) (lecture, 2 SWS)
Hutzschenreuter T [L], Hutzschenreuter T
For further information in this module, please click campus.tum.de or here.
Basics in Economics
Module Description

WI000023: Economics II - Macroeconomics  [VWL 2]

Macroeconomics
TUM School of Management

Module Level: Bachelor
Language: German
Duration: one semester
Frequency: summer semester
Credits:* 6
Total Hours: 180
Self-study Hours: 120
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The exam will be a written test (120 min.) at the end of the term. The exam is designed to assess the participants' capabilities to apply macroeconomic theory in order to discuss and solve real world problems of the economy as a whole. Participants should demonstrate their capacity for abstraction (thinking in economic models), concretization (calculating, interpreting and applying the results of the model, mathematical processing as well as graphical illustration).

Repeat Examination:
Next semester

(Recommended) Prerequisites:
no specific prerequisites

Content:
This module provides an introduction to basic concepts of macroeconomics. It covers:
- key institutions of capitalism as an economic system (private property, firms, markets)
- technological change as a trigger for economic growth
- price-taking and competitive markets
- price-setting, rent-seeking and market disequilibrium
- market successes and failures
- markets, contracts and information
- credit, banks and money
- economic fluctuations and unemployment
- unemployment, inflation, fiscal and monetary policy
- technological progress and living standards
- the Great Depression, the golden age of capitalism and the global financial crisis

Intended Learning Outcomes:
After attending the module, students will able to describe the composition and distribution of the Gross Domestic Product. They can analyze the economic mechanisms underlying unemployment as well as issues regarding monetary policy and inflation. Further, participants will learn to understand the economic crisis and the wealth differences among nations. Students are enabled to think in models and apply mathematical solutions when approaching economic problems.

Teaching and Learning Methods:
The module consists of a lecture and an exercise course. The lecture content will be delivered in a verbal
presentation with the help of slides. Since the foundation of the lecture is a textbook including recent economic history, the teaching is full of real life examples. The content of the lecture is put into practice in the exercise course which applies the theoretical knowledge by basic mathematical calculations and graphical illustrations. Therefore, the module aims at encouraging participants to independently think about economic problems discussed in the lecture and in the current literature. Students are enabled to use the instruments (abstract and model thinking) for operationalizing economic problems and solve them in the conventional, mathematical manner.

This module is also offered at TUM Campus Straubing.

Media:
http://www.core-econ.org/

Reading List:

Responsible for Module:
Hottenrott, Hanna; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Economics II Exercise in German (WI000023 / CS0067) at Campus Straubing (exercise, 2 SWS)
Goerg S [L], Goerg S

Economics II (Macroeconomics) (WI000023 / CS0067) at Campus Straubing (lecture, 2 SWS)
Goerg S [L], Goerg S

For further information in this module, please click campus.tum.de or here.
Module Description

WI000023_E: Economics II - Macroeconomics

Macroeconomics
TUM School of Management

Module Level: Bachelor
Language: English
Credits:* 6
Total Hours: 180
Self-study Hours: 120
Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The exam will be a written test (120 min.) at the end of the term. The exam is designed to assess the participants' capabilities to apply macroeconomic theory in order to discuss and solve real world problems of the economy as a whole. Participants should demonstrate their capacity for abstraction (thinking in economic models), concretization (calculating, interpreting and applying the results of the model, mathematical processing as well as graphical illustration).

Repeat Examination:
Next semester

(Recommended) Prerequisites:
no specific prerequisites

Content:
This module provides an introduction to basic concepts of macroeconomics. It covers:
- key institutions of capitalism as an economic system (private property, firms, markets)
- technological change as a trigger for economic growth
- price-taking and competitive markets
- price-setting, rent-seeking and market disequilibrium
- market successes and failures
- markets, contracts and information
- credit, banks and money
- economic fluctuations and unemployment
- unemployment, inflation, fiscal and monetary policy
- technological progress and living standards
- the Great Depression, the golden age of capitalism and the global financial crisis

Intended Learning Outcomes:
After attending the module, students will able to describe the composition and distribution of the Gross Domestic Product. They can analyze the economic mechanisms underlying unemployment as well as issues regarding monetary policy and inflation. Further, participants will learn to understand the economic crisis and the wealth differences among nations. Students are enabled to think in models and apply mathematical solutions when approaching economic problems.

Teaching and Learning Methods:
The module consists of a lecture and an exercise course. The lecture content will be delivered in a verbal
presentation with the help of slides. Since the foundation of the lecture is a textbook including recent economic history, the teaching is full of real life examples. The content of the lecture is put into practice in the exercise course which applies the theoretical knowledge by basic mathematical calculations and graphical illustrations. Therefore, the module aims at encouraging participants to independently think about economic problems discussed in the lecture and in the current literature. Students are enabled to use the instruments (abstract and model thinking) for operationalizing economic problems and solve them in the conventional, mathematical manner.

Media:
http://www.core-econ.org/

Reading List:

Responsible for Module:
Hottenrott, Hanna; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Economics II (WI000023_E) (Macroeconomics) (lecture, 2 SWS)
Hottenrott H

Economics II - Exercise (WI000023_E) (exercise, 2 SWS)
Mukherjee A

For further information in this module, please click campus.tum.de or here.
Basics in Law
Business Law
Module Description

WI000027: German Business Law I [WPR 2]

TUM School of Management

Module Level: Bachelor
Language: German
Duration: one semester
Frequency: winter semester
Credits:* 6
Total Hours: 180
Self-study Hours: 120
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
In the final assessment students will need to demonstrate to what extent they have met the Learning Objectives. This assessment will be held as a written exam of 120 minutes. The exam consists of two parts which count for approximately 50 per cent each.
In the first part, students will be asked theoretical questions. This will demonstrate to what extent they have memorised and understood principles of the law of contracts (formation, discharge, and liability), tort law and property law.
Students will also be asked to apply their knowledge to known and fictional cases. This second part demonstrates if students have developed the required legal analytical skills. Students also need to demonstrate their ability to their knowledge to fact settings not discussed in the lecture, and to evaluate the legal consequences.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
none

Content:
This module provides an introduction to basic concepts of German Civil Law.
It is separated into a lecture and a tutorial (case studies).
Topics covered are:
- legal capacity, capacity to contract, protection of minors
- declaration of intent, contract, representation, appearance of a legal position
- Law of obligations - general rules: creation, content and termination of obligations, General Terms and Conditions, consumer protection in specific marketing channels (distance selling, door-to-door sale)
- Law of obligations - special rules: agreement categories, act of sale/contract for services, defaults (breach of duty), cancellation, abatement, compensation, purchase of consumer goods
- Unjust enrichment
- Law of torts
- Property law

Intended Learning Outcomes:
At the end of this subject students will be able
(1.) to understand the basic principles of German civil law,
(2.) to grasp the legal framework of business activity, in particular regarding liability under tort and contract,
(3.) to analyse legal implications of typical business situations and to identify their options,
(4.) to present the results of their analysis in a written memorandum.
Teaching and Learning Methods:
This module comprises the lecture "German Business Law I" and the tutorial "Case Studies in Business Law I". The lecture will cover the theoretical aspects of the module in a discussion with the lecturer. The tutorial will focus on case studies. It will provide the opportunity to work individually or in groups on case scenarios (known and unknown), covering issues of contract, tort and property law. The purpose is to repeat and to intensify the content discussed in the lecture and to review and evaluate legal issues from different areas of law in everyday situations. Students will develop the ability to present these findings in a concise and well-structured written analysis.

This module is also offered at TUM Campus Straubing.

Media:
Presentations (PPT), Case studies (including model answers)

Reading List:
Legislative Text: Bürgerliches Gesetzbuch, Zivilprozessordnung
Literature: Ann/Hauck/Obergfell, Wirtschaftsprivatrecht kompakt

Responsible for Module:
Ann, Christoph; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Business Law 1 (BGB) (WI000027) (lecture, 2 SWS)
Böttcher E

Introduction to Case Studies in Business Law, Part 1 (WI000027) at Campus Straubing (exercise, 2 SWS)
Koch J

Business Law 1 (BGB) (WI000027) at Campus Straubing (lecture, 2 SWS)
Koch J

Introduction to Case Studies in Business Law, Part 1 (WI000027) (exercise, 2 SWS)
Schregle R, Speer A, van der Linde T

For further information in this module, please click campus.tum.de or here.
Module Description

WI000030: German Business Law II  [WPR 2]

TUM School of Management

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<td>Bachelor</td>
<td>German</td>
<td>one semester</td>
<td>summer semester</td>
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Credits:* 180
Total Hours: 120
Self-study Hours: 60
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
In the final assessment students will need to demonstrate to what extent they have met the Learning Objectives. This assessment will be held as a written exam of 120 minutes. The exam consists of two parts which count for approximately 50 per cent each.
In the first part, students will be asked theoretical questions. This will demonstrate to what extent they have memorised and understood principles of the law of collateral security, commercial law and company law.
Students will also be asked to apply their knowledge to known and fictional cases. This second part demonstrates if students have developed the required legal analytical skills. Students also need to demonstrate their ability to apply their knowledge to fact settings not discussed in the lecture, and to evaluate the legal consequences.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Empfohlen: Teilnahme am Modul WI000027 Wirtschaftsprivatrecht I

Content:
This module provides an overview of German Commercial Law, German Company Law, and the law of collateral security.
It is separated into a lecture and a tutorial.
Topics covered are:
- The merchant
- Representation under the system of German Commercial Code
- Commercial register
- Commercial firm and company
- Merchant's auxiliary persons
- Trading operations
- Credit and Security
- Company Law (partnerships, corporate enterprises)

Intended Learning Outcomes:
At the end of this subject students will be able
(1.) to understand the basic principles of German commercial law, company law, and the law of collateral security,
(2.) to grasp the legal framework of business activity, in particular regarding contractual relationships among merchants,
(3.) to analyse legal implications of typical business situations and to identify their options,
(4.) to present the results of their analysis in a written memorandum.
This module comprises the lecture "German Business Law II" and the tutorial "Case Studies in Business Law II". The lecture will cover the theoretical aspects of the module in a discussion with the lecturer. The tutorial will focus on case studies. It will provide the opportunity to work individually or in groups on case scenarios (known and unknown), covering issues of commercial law, company law, and the law of collateral security. The purpose is to repeat and to intensify the content discussed in the lecture and to review and evaluate legal issues from different areas of law in everyday situations. Students will develop the ability to present these findings in a concise and well-structured written analysis.

This module is also offered at TUM Campus Straubing.

Media:
Presentations (PPT), Case studies (including model answers)

Reading List:
Legislative Text:
Bürgerliches Gesetzbuch, Handelsgesetzbuch, GmbH-Gesetz, Aktiengesetz

Literature:
Ann/Hauck/Obergfell, Wirtschaftspravatrecht kompakt

Responsible for Module:
Ann, Christoph; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
German Business Law II (WI000030) (lecture, 2 SWS)
Koch J

Introduction to Case Studies in Business Law, Part 2 (WI000030) (exercise, 2 SWS)
Zimmermann P

For further information in this module, please click campus.tum.de or here.
Business Law (E)
# Module Description

**WI001119: Business Law I [BusLaw]**

**TUM School of Management**

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<td>one semester</td>
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<td>6</td>
<td>180</td>
<td>120</td>
<td>60</td>
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</table>

Number of credits may vary according to degree program. Please see Transcript of Records.

**Description of Examination Method:**

In the final assessment students will need to demonstrate to what extent they have met the Learning Objectives. This assessment will be held as a written exam of 120 minutes in which students are allowed to use the applicable statutory law. The exam consists of two parts which count for approximately 50 per cent each.

In the first part, students will be asked theoretical questions. This will demonstrate to what extent they have memorised and understood principles of the law of contracts (formation, discharge, and liability), torts, and company law under German, European and Common Law. Students will also be asked to apply their knowledge to known and fictional cases. This second part demonstrates if students have developed the required legal analytical skills. Students also need to demonstrate their ability to apply their knowledge to fact settings not discussed in the lecture, and to evaluate the legal consequences.

**Repeat Examination:**

Next semester

**(Recommended) Prerequisites:**

This module covers the legal essentials of running a business. It includes an overview of the legal framework in Germany and Europe, the formation and termination of contracts, selected types of contract (in particular, sale of goods), torts, property law, and company law. The module covers aspects of the German legal framework as well as the common law. This module is a prerequisite for "Business Law 2". It cannot be replaced with "Wirtschaftsprivatrecht 1".

**Content:**

This module covers the legal essentials of running a business. It includes an overview of the legal framework in Germany and Europe, the formation and termination of contracts, selected types of contract (in particular, sale of goods), torts, property law, and company law. The module covers aspects of the German legal framework as well as the common law. This module is a prerequisite for "Business Law 2". It cannot be replaced with "Wirtschaftsprivatrecht 1".

**Intended Learning Outcomes:**

At the end of this module students will be able
(1.) to name and understand the rules and principles of both German business law and the common law which are most important for businesses,
(2.) to grasp and apply the legal principles regulating business activity, in particular regarding liability under tort, contract and company law;
(3.) to analyse legal implications of typical business situations and to identify their options;
(4.) to present the results of their analysis in a written analysis.

**Teaching and Learning Methods:**

The lecture will cover the theoretical aspects of the module in a discussion with the lecturer. The tutorial will focus on case studies. It will provide the opportunity to work individually or in groups on case scenarios (known and unknown), covering various issues of German and the common law. The purpose is to repeat and to intensify the
content discussed in the lecture and to review and evaluate legal issues from different areas of law in everyday situations. Students will develop the ability to present these findings in a concise and well-structured written analysis.

**Media:**
Reader, Presentations (PPT), Cases

**Reading List:**

**Responsible for Module:**
Maume, Philipp; Prof. Dr.

**Courses (Type of course, Weekly hours per semester), Instructor:**

For further information in this module, please click campus.tum.de or here.
Module Description

WI001120: Business Law II  [BusLaw 2]

TUM School of Management

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<td>120</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
In the final assessment students will need to demonstrate to what extent they have met the Learning Objectives. This assessment will be held as a written exam of 120 minutes. In this exam students will be asked theoretical questions. This will demonstrate to what extent they have memorised and understood principles of EU law. Students will also be asked to apply their knowledge of EU law to known and fictional cases. This demonstrates if students have developed the required legal analytical skills. Students also need to demonstrate their ability to apply their knowledge to fact settings not discussed in the lecture, and to evaluate the legal consequences.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Recommended: Attendance of WI001119 Introduction to Business Law.

Content:
This module provides an overview of the laws of the European Union that are relevant for national and international businesses. Topics covered are the concept of internal market & 5 freedoms, the EURO, EU trade law, EU company and securities laws, EU competition law & state aids, EU IP & licensing agreements.

Intended Learning Outcomes:
At the end of this module students will be able
(1.) to name and understand the rules and principles of EU law which are most important for businesses,
(2.) to grasp and explain the framework of EU economic policies, in particular the interaction between EU law and member state law,
(3.) to identify and analyse restraints prescribed by EU law from the perspective of businesses and employees,
(4.) to assess real life scenarios regarding their EU law implications.

Teaching and Learning Methods:
The module will cover the theoretical aspects of EU law in a discussion with the lecturer. It will also provide the opportunity to work individually or in groups on case scenarios covering issues of EU law. The purpose is to repeat and to intensify the content discussed in the lecture and to review and evaluate legal issues. Students will develop the ability to present these findings in a concise and well-structured analysis.

Media:
Reader, Presentations (PPT), Cases
**Reading List:**
Schütze, An Introduction to European Law (2012); Chalmers/Davies/Monti, European Union Law (3rd ed., 2014)

**Responsible for Module:**
Maume, Philipp; Prof. Dr.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Business Law II - Case studies (WI001120) (exercise, 2 SWS)
Fromberger M

Business Law II (WI001120) (lecture, 2 SWS)
Maume P

For further information in this module, please click [campus.tum.de](http://campus.tum.de) or [here](http://here).
Specialization in Technology
Specialization in Technology: Chemistry

If students choose the specialization in technology Chemistry, they must successfully complete all modules listed.
Module Description

CH0106: Biology for Chemists

TUM School of Management

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Credits:* | Total Hours: | Self-study Hours: | Contact Hours: |
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Keine

Content:
Der Inhalt des Moduls umfasst die Grundlagen der Biochemie: Chemische Grundlagen; Moleküle des Lebens (Stoffklassen: Kohlenhydrate, Lipide, Nukleinsäuren, Aminosäuren); Grundlagen von Leben; Energie; genetische Information; DNA; Genom; Replikation; Transkription; Translation; Zellaufbau (Zytologie; Zytoskelett; Zell-Zell-Interaktionen (Gewebe); Zellzyklus; Fortpflanzung; Vererbung und Evolution; chemische Evolution; Ökologie; Immunologische Grundlagen; Grundlagen der DNA-Rekombinationstechnik.

Intended Learning Outcomes:

Teaching and Learning Methods:
Das Modul besteht aus der Vorlesung Biologie für Chemiker (2 SWS) und einer begleitenden Übungsveranstaltung (1 SWS). Die Inhalte der Vorlesung werden im Vortrag, Präsentationen und Tafelanschriften vermittelt. Begleitend sollen die Studierenden die behandelten Inhalte durch Durchsicht eines geeigneten Lehrbuchs weiter vertiefen.
der Übung werden die Inhalte der Vorlesung durch die Bearbeitung eines Fragenkatalogs ebenfalls weiter vertieft.

**Media:**
Vortrag mittels PowerPoint, Tafelanschrift, Skriptum, Übungsaufgabensammlung, Filme

**Reading List:**
Als Lehrbuch begleitend zum Modul: Campell/Reece, Biologie, Pearson Education und Alberts/Johnson/Lewis/Raff/Roberts/Walter, Molekularbiologie der Zelle, Wiley VCH.

**Responsible for Module:**
Buchner, Johannes; Prof. Dr.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Biology for Chemists (Lecture w/ Exercise, 3 SWS)  
Buchner J, Haslbeck M

For further information in this module, please click campus.tum.de or here.
Module Description

CH0107: Analytical Chemistry

TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Grundwissen in Chemie und Physik.

Content:

Intended Learning Outcomes:
Nach der Teilnahme am Modul sind die Studierenden in der Lage, die einzelnen Schritte einer chemischen Analyse von Probenahme, Probenaufbereitung, Messung, Auswertung und Validierung zu erinnern und deren Eigenheiten und Wichtigkeit zu verstehen und anzuwenden. Sie können verschiedene moderne Analyseverfahren wie AAS, OES, RFA, MS und Kopplungsverfahren benennen und erklären.

Teaching and Learning Methods:
Das Modul besteht aus einer Vorlesung deren Inhalt im Vortrag und durch Präsentationen vermittelt wird. Studierende werden zur inhaltlichen Auseinandersetzung mit der Thematik und zum Studium der Literatur angeregt.

Media:
Bücher, Online-Skript

Reading List:

Responsible for Module:
Schuster, Michael; Prof. Dr. phil. nat.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.
Module Description

CH0575: General and Inorganic Chemistry [CH0575]

TUM School of Management

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<td>one semester</td>
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Credits:*  
Total Hours: 180  
Self-study Hours: 120  
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Repeat Examination:  
End of Semester

(Recommended) Prerequisites:  
Voraussetzung ist Interesse an Chemie als experimentelle Naturwissenschaft.

Content:
Aufbau der Materie; Chemie, Stoffe, Stofftrennung; Atombau und Periodensystem der Elemente; Moleküle, chemische Verbindungen; Chemische Bindung; Chemische Reaktionen; Chemische Gleichgewichte; Säuren und Basen; Festkörperchemie, Festkörperstrukturen; Elektrochemie; Grundlegende Stoffkenntnisse zu Hauptgruppenelementen; wichtige technische Verfahren.

Intended Learning Outcomes:

Teaching and Learning Methods:
Das Modul besteht aus einer Vorlesung (4 SWS), in welcher die Inhalte im Vortrag und durch Präsentationen vermittelt werden. Die Studierenden sollen zum Studium der Literatur und der inhaltlichen Auseinandersetzung mit den Themen angeregt werden. Die Präsentationen werden über einen download- Bereich zur Verfügung gestellt. Mit Übungsaufgaben, die durch Tafelanschrieb präsentiert und gelöst werden, werden konkrete Fragestellungen

**Media:**
PowerPoint-Präsentationen, Tafelanschrieb, Frontalübungen, Videos, Versuchsvorführung, Übungsblätter, Moodle

**Reading List:**
- Riedel/Janiak Anorganische Chemie 9. Auflage 2015 (de Gruyter);

**Responsible for Module:**
Köhler, Klaus; Prof. Dr.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Experimental Inorganic Chemistry (lecture, 4 SWS)
Köhler K

For further information in this module, please click [campus.tum.de](http://campus.tum.de) or [here](http://here).
Module Description

CH0999: Chemistry Software and Databases for TUM-BWL

TUM School of Management

Module Level: Bachelor
Language: German
Duration: one semester
Frequency: summer semester
Credits:* 3
Total Hours: 90
Self-study Hours: 60
Contact Hours: 30

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Keine

Content:
Moleküle am Computer (ViewerLite), Molekülstrukturen im Internet (CSD, PDB), Protein Services im Internet (PSBSum, SCOP, PROSITE), Literatur Online (EZB, CAS, SciFinder, Reaxys, PubMed), Einfaches Molecular Modeling (Molecular Mechanics mit HyperChem).

Intended Learning Outcomes:
Nach Bestehen des Moduls ist der Studierende in der Lage, chemische Datenbanken zu verwenden und insbesondere eine (Sub-) Strukturformelsuche anzuwenden. Der Studierende versteht, wie die einzelnen Datenbanken aufgebaut sind und kann analysieren, welche Datenbank für welche Fragestellung am besten geeignet ist. Er versteht die Grundprinzipien des Molecular Modeling und kann die Suche nach einer Strukturformel mit minimaler Gesamtenergie anwenden.

Teaching and Learning Methods:
Media:
Powerpoint, Skript, Molecular Modelling-Program, Versuchsskript. Literaturstudium.

Reading List:
Geeignete Literatur wird vom Dozenten bekannt gegeben.

Responsible for Module:
Fontain, Eric; PD Dr. rer. nat. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Chemistry Software and Databases for TUM-BWL (Lecture w/ Exercise, 2 SWS)
Fontain E

For further information in this module, please click campus.tum.de or here.
### Module Description

**CH1000: Chemical Laboratory Course for TUM-BWL**

**TUM School of Management**

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<td>180</td>
<td>90</td>
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### Description of Examination Method:

Die Prüfungsleistung besteht aus zwei Teilleistungen: Einer Laborleistung (Gewichtung: 75%) und einer schriftlichen, 90-minütigen Klausur (Gewichtung: 25%). In den Prüfungsleistungen sollen die Studierenden zeigen, dass sie die theoretischen Hintergründe und die praktischen Vorgehensweisen zur qualitativen und quantitativen Bestimmung von Analysen, zur Chemie aus Alltag und Technik, zur préparativen organischen Chemie und zu analytischen Methoden der organischen Chemie beherrschen.


### Repeat Examination:

End of Semester

### (Recommended) Prerequisites:

Module "Einführung in die Organische Chemie" und "Allgemeine und anorganische Chemie"

### Content:

Praktische Modulinhalte:
- Methoden zur quantitativen Bestimmung von Analysen (Neutralisationstitration, Komplexometrie, Potentiometrie, Photometrie) als auch Methoden zur qualitativen Bestimmung von Analysen (Kationentrennungsgang, Anionennachweise).
- Experimentelle Grundkenntnisse zur Chemie aus Alltag und Technik (Elektrochemie, Wasseranalytik, Naturstoffextraktion, Polymerisation).
- Experimentelle Grundkenntnisse der präparativen organischen Chemie: Drei präparative Grundoperationen (Destillation, Kristallisation, Extraktion), einfache Synthesen.
- Die erhaltenen Verbindungen werden mit diversen analytischen Methoden (NMR-Spektroskopie, Gaschromatographie, Massenspektrometrie, Schmelz- und Siedepunktbestimmung, Brechungsindexbestimmung) charakterisiert.

Theoretische Modulinhalt:
- Übungen zur Literaturrecherche von chemischen Verbindungen sowie der Methoden zur Strukturaufklärung.

Intended Learning Outcomes:
Nach der Teilnahme am Modul "Chemisches Praktikum für TUM-BWL" wissen die Studierenden neben den theoretischen Hintergründen auch die praktischen Vorgehensweisen zur qualitativen und quantitativen Bestimmung von Analysen, zu ausgewählten Beispielen aus der Chemie in Alltag und Technik sowie um ein einfaches Verständnis der Verbindungen zu erlangen. Sie lernen, wie sie die Reaktionsprodukte durch eine Vielzahl von Methoden (NMR-Spektroskopie, Gaschromatographie, Massenspektrometrie, Schmelz- und Siedepunktbestimmung) charakterisieren können.

Teaching and Learning Methods:
Das Modul besteht aus einem Laborpraktikum (4 SWS) und einem begleitenden Seminar mit Übungen (2 SWS). Die Inhalte des Praktikums werden durch Experimente vermittelt, die Beobachtungen und Ergebnisse in einem Laborjournal dokumentiert und die erhaltenen Verbindungen an diversen analytischen Geräten charakterisiert und ausgewertet. Die Theorie zum Versuch, die Versuchs durchführung sowie die Ergebnisse und deren Auswertung und Interpretation werden in Form von Protokollen und Ausarbeitungen schriftlich festgehalten.

Media:
Bücher, Powerpointpräsentationen, Tafelanschrieb, Frontalübungen, Skript, Laborkurs
Reading List:

Responsible for Module:
Breitenlechner, Stefan; Dr. rer. nat.

Courses (Type of course, Weekly hours per semester), Instructor:
--- (practical training, 4 SWS)
Bach N, Breitenlechner S

--- (seminar, 2 SWS)
Breitenlechner S

For further information in this module, please click campus.tum.de or here.
Module Description

CH1090: Introduction to Organic Chemistry

TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Lectures in Basic and inorganic chemistry.

Content:
Introduction:
What is Organic Chemistry? Structural units, alkyl chains, functional groups, structural principles, isomerism, geometry, chirality

 Hydrocarbons:
Alkanes, cycloalkanes, alkenes, alkynes, aromaticity, aromatics

 Oxygen compounds:
Polar bond, alcohols, ethers, aldehydes, ketones, carboxylic acids, esters

 Petroleum, petrochemicals, fuels, triglycerides:
Petroleum and petrochemicals, fats, oils, triglycerides, fatty acids, modern fuels, bioethanol, biodiesel, synthetic fuels

 Water and organic molecules:
The structure of water, entropy, hydrophilicity, hydrophobicity, polar and non-polar solvents, surfactants, fat hydrolysis, phospholipids

 Organic dyes and pigments:
Creation and perception of light and color, chromophores, natural organic dyes indigo and madder, triphenylmethane-, tar-, azodyes, phthalocyanines, modern high-performance pigments, optical brighteners
Carbohydrates:
Glucose and isomeric sugar, hemiacetal formation and pyranoses, mono-, di-, and polysaccharides, starch, cellulose

Proteins:
Amino acids and peptide bond, peptides, proteins, primary, secondary, tertiary structure, the key - lock principle, fibrous proteins: keratins, collagen

Plastics:
Thermoplastics, elastomers and thermosets, polymer types, polymerization and the polymerisates, polycondensation and polycondensates, polyaddition and polyadducts

In-depth knowledge:
Industrial organic chemistry: pharmaceuticals, evaluation of chemical reactions: yield and atom economy, terpenes, DNA and RNA

**Intended Learning Outcomes:**
After participating in the module, the students are able to evaluate the organic chemistry of important compounds in nature and technology. They understand structural principles and properties of the basic classes of natural products. Students are familiar with the basic modes of reaction of organic compounds.

**Teaching and Learning Methods:**
The module consists of a lecture with accompanying exercises. The contents are taught in lecture and through presentations. Students should be encouraged to substantive discussion of the issues and to study advanced literature. Exercises are given in correlation to the lecture progress and will be discussed centrally after a given processing time.

**Media:**
Script, presentation, exercise sheets.

**Reading List:**

**Responsible for Module:**
Fontain, Eric; PD Dr. rer. nat. habil.

**Courses (Type of course, Weekly hours per semester), Instructor:**
English title will be supplied (exercise, 1 SWS)
Fontain E

English title will be supplied (lecture, 3 SWS)
Fontain E

For further information in this module, please click campus.tum.de or here.
Module Description

CH1091: Basic Principles of Physical Chemistry 1

TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The examination is done in the form of a written exam (90 minutes). In this, it should be demonstrated that in limited time and without aids a problem is identified and ways to a solution can be found. To demonstrate the learning outcomes achieved, students should recognize the statistical nature of thermodynamics and kinetics and remember the Gibbsian formalism. The students understand the role of state functions and their function in thermochemistry, equilibrium and kinetics and can explain this. Furthermore, the students show that they can apply the solved equations to concrete problems of thermodynamics and kinetics. They know standard phenomena of thermodynamics and kinetics and can formally analyze them. The exam questions go over the entire module material. The answers partly require own calculations and phrasing, partly ticking of predetermined multiple answers.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Introduction to General chemistry

Content:
1) Equations of state for ideal and real gases (intermolecular interactions, van der Waals equation, and virial development).
2) Kinetic theory of gases, specific heat, translational, rotational and vibrational degrees of freedom, Boltzmann and Maxwell distribution (including basic statistical considerations).
3) 1 Law: Internal energy and enthalpy as a state function, isothermal and adiabatic processes, Joule-Thomson effect, Thermochemistry: set of Hess, Kirchhoff's sentence, Haber-Born cycle.
4) 2 Law: reversible and irreversible processes, Carnot cycle, entropy, 3. Law, phase transition and Trouton'sche rule, efficiency, heat pump, free energy / free enthalpy (maximum work).
5) Equilibrium: partial molar quantities, chemical potential, Herry's and Raoult law, law of mass action, thermodynamic and other equilibrium constants, pressure dependence, Le Chatelier, van't Hoff equation, activity.
6) Formal kinetics, first and second order, parallel and consecutive reactions, pseudo first order, enzyme kinetics, relaxation to equilibrium, steady state.

Intended Learning Outcomes:
After attending this module, students should be able to: 1) recognize the statistical nature of thermodynamics and kinetics, and to remember the Gibbs formalism. 2) understand and explain the importance of state functions and its function in the thermochemistry, the equilibrium and kinetics a. 3) apply and solve the developed equations to concrete problems of thermodynamics and kinetics. 4) analyze formally standard phenomena of thermodynamics and kinetics.
Teaching and Learning Methods:
The module consists of a lecture (3 SWS) and an accompanying exercise (1 SWS). The contents of the course will be taught in lecture and through presentations and animation, whereby the relationship between formal tool, microscopic theory and diversity is explained. Practice sheets containing specific problems are distributed weekly for self study. In the practice sessions the self found solutions are discussed and the tasks are solved and commented afterwards. Detailed solutions can be found on the internet and include: 1) a sketch of the solution approach, 2) a complete solution with all steps of calculation and references to typical failures, 3) advanced information material to stimulate self-study.

Media:
Presentation on blackboard and projector, script

Reading List:

Responsible for Module:
Bachmann, Annett; Dr. phil.

Courses (Type of course, Weekly hours per semester), Instructor:
English title will be supplied (exercise, 1 SWS)
Bachmann A

English title will be supplied (lecture, 3 SWS)
Bachmann A

For further information in this module, please click campus.tum.de or here.
Module Description

CH1123: Chemical Engineering for TUM-BWL

TUM School of Management

Module Level: Bachelor
Language: German
Credits:* 6
Duration: one semester
Total Hours: 180
Self-study Hours: 120
Frequency: summer semester
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Grundkenntnisse in organischer Molekülchemie sowie in physikalischer und analytischer Chemie

Content:
Modulinhalt zur Technischen Chemie:
- Polymerisationsart (radikalisch, ionisch, koordinativ)
- Polymerisationsverfahren
- Reaktionsgeschwindigkeit
- Aggregatzustand von Monomeren und Polymeren
- Löschlichkeit von Monomeren und Polymeren
- Wärmeentwicklung (Temperaturkontrolle)
- Viskosität
- Suspensions- und Emulsionspolimerisation
- Molmassenverteilung Polymerisationsgrad
- Einfluss von Verunreinigungen
- Betriebsweise: kontinuierlich oder diskontinuierlich (Wahl des Reaktors)
- Technische Möglichkeiten zum Stofftransport
- Verweilzeit (Verweilzeitverhalten)
- Wirtschaftliche Aspekte wie Energieaufwand, Kosten, Preise etc.

Modulinhalt zur Reaktionstechnik und Katalyse:

CH1123: Chemical Engineering for TUM-BWL
Generated on 11.03.2020
Einfache und komplexere kinetische Beschreibungen von Reaktionen, Sorption, Katalytische Reaktion als sequentielle und parallele Netzwerke, ideale Reaktoren, reale Reaktionen, Auslegung idealer Reaktoren, Wärme- und Stofftransport; Grundlegende Elemente katalysierter Reaktionen.

**Intended Learning Outcomes:**

**Teaching and Learning Methods:**

**Media:**
Folien, Tafelarbeit, PowerPoint, Skript

**Reading List:**
- Martin Brahms (Hirzel Verlag Stuttgart)
  Polymerchemie Kompakt
- Wilhelm Keim (Wiley-VCH)
  Kunststoffe
  Synthese, Herstellungsverfahren, Apparaturen
- Hans-Georg Elias (Wiley-VCH)
  Makromoleküle
  Band 3: Industrielle Polymere und Synthesen
- Adolf Echte (Wiley-VCH)
  Handbuch der technischen Polymerchemie
- [http://www.chemgapedia.de/vsengine/topics/de/vlu/Chemie/Makromolekulare_00032Chemie/index.html](http://www.chemgapedia.de/vsengine/topics/de/vlu/Chemie/Makromolekulare_00032Chemie/index.html)

**Responsible for Module:**
Troll, Carsten; Dr. rer. nat.

**Courses (Type of course, Weekly hours per semester), Instructor:**
English title will be supplied (lecture, 2 SWS)
Lercher J, Ember E

English title will be supplied (lecture, 2 SWS)
Troll C, Rieger B

For further information in this module, please click [campus.tum.de](http://www.campus.tum.de) or [here](http://www.campus.tum.de).
Specialization in Technology: Informatics

If students choose the specialization in technology Informatics, they must earn 36 credits from required modules and a minimum of 6 credits from an elective module. Below is a sample catalog of elective modules.
Required Modules Informatics
Module Description

IN0001: Introduction to Informatics 1

TUM School of Management

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<td>180</td>
<td>120</td>
<td>60</td>
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</table>

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Type of Assessment: exam (120 minutes)

The exam takes the form of 120 minutes written test. Questions allow to assess acquaintance with concepts of Informatics and programming, small programming tasks assess the ability to conceive appropriate algorithmic solutions and realize concurrent applications.

Repeat Examination:

End of Semester

(Recommended) Prerequisites:

Participants should attend IN0002 "Fundamentals of Programming (Exercises & Laboratory)" at the same time.

Content:

The module IN0001 is concerned with topics such as:

- Introduction
  - Basic notions: Problem - algorithm - program
  - Imperative programming constructs
- Syntax and semantics
  - Syntax of programming languages: regular expressions and context-free grammars
  - Semantics of programs: control-flow graphs
- Basic data structures I
  - Numbers, strings, arrays
  - Insertion sort
- Recursion
  - Binary search
  - Patterns of recursion
- Basic data structures II
  - Objects, classes, methods
  - Lists, stacks, queues
- Object-oriented programming
  - Inheritance
  - Abstract classes and interfaces
  - Polymorphism
- Programming in the large (perspectives)
- Concurrency and Threads
Intended Learning Outcomes:
Upon successful completion of the module participants understand the essential concepts of computer science on a fundamental, practice-oriented, but scientific level. Concepts of this kind are for example: Algorithms, syntax and semantics, as well as efficiency in terms of memory consumption or time. Participants are then able to solve well-posed algorithmic problems and to implement basic distributed and concurrent applications in Java or a similar object-oriented language. They understand the underlying concepts and models and are therefore able to acquire skills in other imperative and object-oriented programming languages on their own.

Teaching and Learning Methods:
lecture, combined with experimental assessment of examples at the computer and evaluation of further readings

Media:
slide show, blackboard, online programming experiments, animations, lecture recording

Reading List:
Heinisch, Müller-Hofmann, Goll: Java als erste Programmiersprache, Teubner, 2007
Deitel, Harvey / Deitel, Paul: How to program Java Prentice-Hall, 2002
Flanagan, David: Java in a Nutshell O'Reilly, 2002
Bishop, Judith: Java gently Prentice-Hall, 2001
Eckel, Bruce: Thinking in Java Prentice-Hall, 2002

Responsible for Module:
Seidl, Helmut; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Introduction to Informatics 1 (IN0001) (lecture, 4 SWS)
Seidl H, Erhard J, Hagerer G, Kynast E

For further information in this module, please click campus.tum.de or here.
Module Description

IN0002: Fundamentals of Programming (Exercises & Laboratory)

TUM School of Management

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<td>180</td>
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</table>

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Type of Assessment: exercise work

On 7 to 14 exercise sheets questions or programming tasks will be posed, which have to be solved and handed in by the participants in written or electronic form. By that participants approve that they are able to do programming in the small by means of an object-oriented programming language such as Java and that they have understood fundamental concepts of Informatics and are able to apply these in order to provide original solutions or programs. In order to identify the individual contributions of the participants they must be able to defend their solutions interactively. Before the beginning of classes, it shall be announced how the single exercise sheets contribute to the final grade.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Participants should attend IN0001 "Introduction to Informatics 1" at the same time.

Content:
Accompanying the module IN0001, assignments may exercise and apply for problem solving concepts, such as:
- basic data structures
- recursion
- objects, classes and methods
- lists, queues, and trees
- advanced concepts of object-oriented programming
- concurrency

Intended Learning Outcomes:
After successful completion of the module, participants are acquainted with the programming language Java or a similar object-oriented programming language and master programming in the small. They are able to realize programs on their own and to apply the fundamental concepts of Informatics as taught in module IN0001, on a basic practical but scientific level.

Teaching and Learning Methods:
Approximately a quarter of the module consists of the processing of exercises for the accompanying module IN0001. These exercises deepen the understanding of fundamental concepts of computer science. During the remainder of the time, the participants develop small sample applications under guidance to develop their programming skills in an object-oriented programming language.
**Media:**
Beamer, slides, whiteboard, software development environment

**Reading List:**
See modul IN0001

**Responsible for Module:**
Seidl, Helmut; Prof. Dr.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Fundamentals of Programming (Exercises & Laboratory) (IN0002), Thu (practical training, 4 SWS)
Seidl H [L], Erhard J, Hagerer G, Kynast E

For further information in this module, please click [campus.tum.de](http://campus.tum.de) or here.
Module Description

IN0006: Introduction to Software Engineering

TUM School of Management

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<th>Module Level:</th>
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</table>

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Type of assessment: written exam
The exam takes the form of a 90 minutes written test. The examination consists of describing the main concepts and methods of each phase of the software engineering process. The students have to apply their knowledge to solve small problems. By means of modelling problems, the students have to show their ability to adequately analyze and evaluate given requirements.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
IN0002 Fundamentals of Programming (Exercises & Laboratory)

Content:
Software engineering is the the establishment and systematic use of engineering principles, methods, and tools for the division of work, the development and application of extensive, complex software systems. It deals with the production and development of software, the organization and modelling of data structures and objects, and the operation of software systems. Topics of the lecture include, among others:
- Modeling with UML
- Process models in software development (linear, iterative, agile)
- Requirements elicitation and analysis (functional model, dynamic model, and object model)
- System design (specification, software architecture, architectural patterns, and design goals)
- Object design and implementation (reuse, design patterns, and interface specification)
- Testing (component test, integration test, and system test)
- Configuration management, build management, and release management
- Software maintenance and evolution
- Project organization and communication

Intended Learning Outcomes:
After successful completion of this module, students are familiar with the basic concepts and methods of the different phases of a project, e.g. modeling the problem, reuse of classes and components, and delivery of the software. They have the ability to select and apply suitable concepts and methods for concrete problems.

The students know the most important software engineering terms and workflows and are able to analyze and evaluate given problems. In addition, students can solve concrete problems in software engineering, e.g. with the help of design patterns.
By means of a slide presentation with animations, the interactive lecture introduces the basic concepts and methods of software engineering and explains them using examples. Small exercises, e.g. quizzes, modelling, and programming tasks, with individual feedback help students to identify whether they have understood the basic concepts and methods. Accompanying tutorials deepen the understanding of the concepts explained in the lecture by means of suitable group exercises and show the application of the different methods with the help of manageable problems in the different phases of software engineering. Homework enables students to deepen their knowledge in self-study. The presentation of the own solution in the accompanying tutorials improves communication skills, which are essential in software engineering. Individual feedback on homework allows students to measure learning progress and improve their skills.

Media:
Lecture with digital slides, livestream, online exercises (programming, modeling, quiz) with individual feedback, discussion forum and communication platform for the exchange between instructors, tutors, and students

Reading List:

Responsible for Module:
Matthes, Florian; Prof. Dr. rer. nat.

Courses (Type of course, Weekly hours per semester), Instructor:
Introduction to Software Engineering (IN0006) (lecture, 3 SWS)
Brügge B [L], Krusche S, von Frankenberg und Ludwigsdorff N, Bernius J

For further information in this module, please click campus.tum.de or here.
Module Description

IN0008: Fundamentals of Databases

TUM School of Management

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<td>Bachelor</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The academic assessment will be done by a 90 minutes written exam. Assignments checking knowledge verify the familiarity with the main concepts of relational database systems. Transfer assignments and small scenarios check the ability to apply and evaluate these concepts systematically and in a qualified manner.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
IN0015 Discrete Structures, IN0001 Introduction to Informatics 1

Content:
SQL, data integrity, theory of relational database design, physical data organisation (storage structures, index structures), query processing, transaction management, main features of error handling (recovery, backup) and multi-user synchronisation, security aspects (authorization), XML data modeling (optional); in the tutorial the content is practiced along concrete examples

Intended Learning Outcomes:
Students are able to apply the essential concepts of relational database systems and can use and evaluate them systematically and in a qualified manner. The students have the expertise to systematically use a database system starting from the conceptual design to the implementation design to the physical design. They are able to formulate even complex queries in SQL and have a basic understanding of logical and physical optimization based on relational algebra. Furthermore they know how to safe-guard a database application with respect to recovery, concurrency control and authorization.

Teaching and Learning Methods:
Lecture, tutorial, problems for individual study, web interface to the data base system HyPer for actively testing SQL queries and self-study of query plans

Media:
Lecture with animated slides

Reading List:
- Alfon Kemper, André Eickler: Datenbanksysteme. Eine Einführung. 8., aktualisierte und erweiterte Auflage, Oldenbourg Verlag, 2011
Responsible for Module:
Kemper, Alfons; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Fundamentals of Databases (IN0008) (lecture, 3 SWS)
Neumann T, Sichert M, Vogel L

Fundamentals of Databases, Exercise Session (IN0008) Groups 1-25 (exercise, 2 SWS)
Sichert M, Vogel L

For further information in this module, please click
campus.tum.de or here.
Module Description

IN0009: Basic Principles: Operating Systems and System Software

TUM School of Management

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<td>Bachelor</td>
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<td>105</td>
<td>75</td>
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</table>

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
In the 90 minutes written exam students have to show their understanding of the subjects, like resource management and the usage of systems software. They have to prove to be able to identify a given problem and find solutions within limited time.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
IN0001 Introduction to Informatics 1 and IN0004 Introduction to Computer Organization and Technology - Computer Architecture are recommended

Content:
Basic concepts: Operating systems; concurrency; parallel programming; low-level programming (processes, memory, communication, resource management; models (abstract, formal) for concurrency, e.g. petri nets; mutual exclusion, synchronization, deadlocks; compiler/linker/loader with library integration, transition to (adequate) hardware basic, machine-oriented programming and C; I/O especially as preparation for networking)

Intended Learning Outcomes:
After visiting this module, students are able to understand the basics, problems and solutions of operating systems and current developments. In addition they understand the components like process and memory management and they are able to analyze and evaluate different strategies and techniques. They learn to apply the acquired basic knowledge to new developments in the area of operating systems as well as system software.

Teaching and Learning Methods:
By means of a slide presentation, the lecture introduces the basic concepts and methods of operating systems and explains them using examples. Accompanying tutorials deepen the understanding of the concepts explained in the lecture by means of suitable group exercises and show the application of the different methods with the help of manageable problems in the different aspects of operating system decomposition. Additional programming exercises enable students to deepen their knowledge in self-study. Feedback and help in programming tutoring sessions allow students to measure learning progress and improve their skills.

Media:
Slides and further documents via moodle
Reading List:

Responsible for Module:
Baumgarten, Uwe; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Basic Principles: Operating Systems and System Software (IN0009) (lecture, 3 SWS)
Ott J [L], Ott J

Basic Principles: Operating Systems and System Software, Exercise Session (IN0009) (exercise, 2 SWS)
Ott J [L], Uhl M, Doan T, Haus M

For further information in this module, please click campus.tum.de or here.
Module Description

IN8024: Information Management for Digital Business Models

TUM School of Management

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<th>Module Level:</th>
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<th>Duration:</th>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The examination consists of a 90 minutes written exam. In the exam, students shall verify without auxiliary means that they are able to understand the fundamentals of information management, apply methods for the determination of information needs, evaluate the quality of information, and analyze models and methods of IM. Furthermore, it is verified that they are able to apply methods for cost estimation, understand the role of "information" as a resource in companies, analyze the relationship between IT and business strategy, and evaluate existing business models and create new business models. Furthermore, students shall verify that they are able to address a given scientific problem independently in the field of information management by writing a term paper.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
The module "Information Management for Digital Business Models" covers the topics of management of information demand, supply, and usage, management of information systems (data, processes, application lifecycle), management of information and communication technology (storage, communication, processing, technology bundles), managerial functions of information management (IM organization, CIO, sourcing, business models, IM and strategy) and the role of information management in companies.

Intended Learning Outcomes:
At the end of the module "Information Management for Digital Business Models" students are able to understand the fundamentals of information management, apply methods for the determination of information needs, evaluate the quality of information, and analyze models and methods of IM. Furthermore, the students are able to apply methods for cost estimation, understand the role of "information" as a resource in companies, analyze the relationship between IT and business strategy, and evaluate existing business models and create new business models.

Teaching and Learning Methods:
The module consists of a lecture, an accompanying exercise and an empirical research part. Contents are taught in lecture and presentations. The Exercise addresses specific questions and exercises are completed in individual and/or group work with several learning activities including studying specialist literature and researching reference materials. The empirical research part includes participating and understanding empirical research projects as well as writing a scientific essay.
Media:
Overheads, PowerPoint, whiteboard, exercise sheets

Reading List:


Responsible for Module:
Krcmar, Helmut; Prof.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click [campus.tum.de](http://campus.tum.de) or [here](http://campus.tum.de).
Elective Modules Informatics
Module Description

IN0003: Functional Programming and Verification

TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The exam takes the form of a 120 minutes written test. Small programming tasks allow to assess whether the students master a functional programming language and are able to realize small implementation problems. By inferring simple invariants they demonstrate that they have understood the principles of program verification and are able to apply these.
The successful completion of homework assignments may contribute to the grade as a bonus. The exact details for this are announced timely at the begin of the lecture.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
IN0001 Introduction to Informatics 1

Content:
Among others, the module IN0003 is concerned with the following topics:
- Correctness of imperative programs
  ++ Verification according to Floyd or Hoare
  ++ Termination
  ++ Procedures
- Basic concepts of functional programming
  ++ Values, variables, functions
  ++ Data structures, pattern matching
  ++ Higher order functions
  ++ Polymorphic types
  ++ Programming in the large: Structures and Functors
- Correctness of functional programs
  +++ Semantics of functional programs
  +++ Verification of functional programs

Intended Learning Outcomes:
After successful completion of the module, participants understand the key concepts of functional programming languages. They are able to solve well presented tasks in a functional programming language. Therefore, they are able to acquire programming skills on their own also in further functional programming languages. They also are familiar with the most important techniques for the verification of imperative and functional programming language and can apply them to simple programs.
Teaching and Learning Methods:
By means of a presentation, either by slides or whiteboard, the lecture transports the concepts of verification and the programming language and illustrates them by examples. Accompanying assignments for individual study deepen the understanding of the concepts explained in the lecture, and train students to apply these to the verification of small programs and to master programming in the given programming language.

Media:
Slide show, blackboard, possibly online programming and/or animations

Reading List:

Responsible for Module:
Seidl, Helmut; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Functional Programming and Verification, Exercise Session (IN0003) (exercise, 2 SWS)
Nipkow T [L], Kappelmann K, Rädle J, Stevens L

Functional Programming and Verification (IN0003) (lecture, 2 SWS)
Kappelmann K, Nipkow T, Rädle J, Stevens L

For further information in this module, please click campus.tum.de or here.
Module Description

IN2119: User Modeling and Recommender Systems

TUM School of Management

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<th>Module Level:</th>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Type of Assessment: written exam

The exam takes the form of a 60 minutes written test. The exam assesses the acquaintance with and understanding of concepts, techniques and thinking in the area of user modeling and recommender systems. Using small problems, the exam allows to assess the ability to link and to apply this knowledge regarding the desired learning outcomes. The exam consists of free-text and multiple choice questions. During the semester, students are provided with (online) exercises that allow them to assess their learning progress and to prepare for the exam.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Recommended requirements are basic knowledge of computer science.

Content:
The module IN2119 is concerned with topics such as:
- Introduction to user modeling, user profile acquisition and management
- User modeling methods, e.g. Bayes networks
- Web document modeling and personalized web search
- Recommender systems principles
- Recommendation methods: collaborative, content-based and hybrid methods
- Additional issues of recommenders, e.g. group recommendation, context-aware and mobile recommenders
- Application areas for personalization, e.g. adaptive hypermedia
- Ubiquitous user modeling and adaptive mobile guides
- Evaluation of adaptive and recommendation systems
- Further issues, e.g. decision making and privacy

Intended Learning Outcomes:
After successful completion of this module, students will have a deeper understanding of the basic principles of user modeling and recommender systems. They can recognize challenges of different methods and have an overview of application areas. They understand the underlying methods, know their advantages and disadvantages and can apply the corresponding algorithms to (simple) examples.

Teaching and Learning Methods:
The lecture is conducted as E-Learning (videos lectures, reading assignments and online exercises), no presence sessions.
Media:
E-Learning material (videos, slides, reader), online exercises (eTests)

Reading List:
The course material contains further literature references.

Responsible for Module:
Ott, Jörg; Prof. Dr.-Ing.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.
Specialization in Technology: Electrical Engineering and Information Technology

If students choose the specialization in technology Electrical and Information Technology, they must earn 37 credits from required modules and a minimum of 5 credits from an elective module. Below is a sample catalog of elective modules.
Required Modules Electrical Engineering and Information Technology
Module Description

El10002: Principles of Electrotechnology [PiET]

TUM School of Management

Module Level: Bachelor
Language: English
Credits:* 6
Total Hours: 180
Self-study Hours: 120
Contact Hours: 60
Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
This module will be assessed in a written final examination (90 min) after the teaching weeks. In this examination it is to verify that the candidates are able to understand the general principles of electrical engineering and to solve relevant problems in the fields covered in this module in a limited time and without any resources. The examination will cover all parts of the lectures and exercises.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Knowledge of electricity and magnetism on high school level.
Basic knowledge of vector analysis.

Content:
Electrostatics:
Electrical charges, Coulomb's law, electrostatic fields, electrostatic potentials and voltages.

Dielectric materials:
Polarisation, dielectric displacement vector, Gauß' law, capacitors and capacitances.

Stationary electrical currents:
Current densities, local and integral Ohm's law, Kirchhoff's laws, resistors and resistivities, electrical networks, voltage and current sources, equivalent circuits, electrical energy and power.

(Electro-)magnetism:
Fundamental terms in magnetism, magnetic dipoles, Dia-, Para-, Ferromagnetism, magnetising field, magnetic induction, Amperé's law, electromagnetic induction, Faraday's law, inductors and inductivities, transformers.

Intended Learning Outcomes:
After participating in the modules lectures and exercises, students are able to understand and apply the basic physical principles of electrical engineering. They have acquired basic knowledge and understanding of some of the underlying problem-solving methods of electrical engineering.

Teaching and Learning Methods:
Teaching methods in lectures and exercises: Lecture-style instructions mainly on the blackboard.
In solving relevant exercises a deeper knowledge of the subject-matters presented in the lectures is sought.
Media:
The following media types are used in the lectures and exercises:
- Explanations and exemplifications on the black board, partly supplemented by computer-aided presentations.
- Downloads on the Internet.
- Exercises are provided with the objective that the students first should solve the problems independent by themselves, solution to the problems will be demonstrated in subsequent exercise sessions, and subsequently will be made available also via download on the Internet.

Reading List:
References will be presented in the first lecture hour.

Responsible for Module:
Schrag, Gabriele; Prof. Dr. rer. nat. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Principles in Electrotechnology (lecture, 3 SWS)
Wittmann F

Principles in Electrotechnology (exercise, 1 SWS)
Wittmann F [L], Hölzl W ( Eßing S )

For further information in this module, please click campus.tum.de or here.
Module Description

EI10003: Analog Electronics  [AE]

TUM School of Management

<table>
<thead>
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<th>Language:</th>
<th>Duration:</th>
<th>Frequency:</th>
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<tbody>
<tr>
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<td>English</td>
<td>one semester</td>
<td>summer semester</td>
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Credits:*  

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<th>Self-study Hours:</th>
<th>Contact Hours:</th>
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<tr>
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<td>150</td>
<td>100</td>
<td>50</td>
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</table>

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
This module will be assessed in a written final examination (90 min) after the teaching weeks. In this examination it is to verify that the candidates are able to understand the general principles of analog electronic circuits and to solve simple but relevant problems in the fields covered in this module in a limited time and without any resources. The examination will cover all parts of the lectures and exercises of this module.

Repeat Examination:  
Next semester

(Recommended) Prerequisites:  
Subject matters as presented in the module "Principle of Electrotechnology"  
Calculus; complex numbers and operations for ac signal analysis

Content:  
Electronic signals  
Circuit analysis (dc, ac)  
Electrical characteristics of electronic devices  
Electronic filters  
Basics of semiconductor¿s physics  
PN Junctions, pn diodes  
Transistors  
Basic Transistor circuits  
Amplifiers

Intended Learning Outcomes:  
After participating in the modules lectures and excercises, students are able to  
- understand and apply the basic principles of analog electronic cicuits  
- have acquired basic knowledge and understanding of some of the basic problem-solving methods of electronic cicuits.

Teaching and Learning Methods:  
Teaching methods in the lectures and excercises: frontal teaching with presentations and on the blackboard. In solving relevant exercises a deeper knowledge of the subject matters of the lessons is sought.

Media:  
The following media types are used in the lectures and excercises:  
- Presentations (also for downloads on the Internet)
- Explanations and exemplifications on the black board
- Exercises are provided with the objective that the students first should solve the problems independent by themselves, the solutions to the problems will be demonstrated in subsequent exercise sessions, and subsequently will be made available also via download on the Internet.

**Reading List:**

**Responsible for Module:**
Schrag, Gabriele; Prof. Dr. rer. nat. habil.

**Courses (Type of course, Weekly hours per semester), Instructor:**

For further information in this module, please click [campus.tum.de](http://campus.tum.de) or here.
Module Description

El1289: Electrical Engineering

TUM School of Management

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<th>Module Level:</th>
<th>Language:</th>
<th>Duration:</th>
<th>Frequency:</th>
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<tbody>
<tr>
<td>Bachelor</td>
<td>German</td>
<td>one semester</td>
<td>summer semester</td>
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</table>

Credits:* | Total Hours: | Self-study Hours: | Contact Hours: |
5          | 150        | 105       | 45         |

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Grundkenntnisse der elektrischen Energietechnik;

Content:
Elektrische Größen und Grundgesetze
Elektromagnetismus
Analogien des elektrischen und magnetischen Feldes
Wechselstromkreise
Drehstromsystem
Elektrische Maschinen
Grundlagen Leistungselektronik
Elektronische Bauelemente
Steuerungstechnik

Intended Learning Outcomes:

Teaching and Learning Methods:
Das Modul besteht aus einer Vorlesung (2SWS) und einer Übung (1SWS). In der Vorlesung wird der Lernstoff mittels PowerPoint-Präsentation vermittelt. Details und Beispiele werden an der Tafel präsentiert. In der Übung werden konkrete Aufgabe und Beispiele an der Tafel vorgerechnet.
Als Lernmethode wird zusätzlich zu den individuellen Methoden des Studierenden eine vertiefende Wissensbildung
durch mehrmaliges Aufgabenrechnen in Übungen angestrebt.

Als Lehreimethode wird in der Vorlesungen und Übungen Frontalunterricht gehalten, in den Übungen auch Arbeitsunterricht (Aufgaben rechnen).

Media:
Folgende Medienformen finden Verwendung: Folienvortrag, Skriptum, Übungen, Laborführungen

Reading List:
* Elektrotechnik, Energiotechnik
  Elpers, Meyer, Skornitzke, Willner
* Taschenbuch der Elektrotechnik
  Kories, Schmidt-Walter
  Verlag Harry Deutsch, ISBN 3-8171-1563-6
* Fachkunde Elektrotechnik
  Verlag Europa-Lehrmittel, ISBN 3-8085-3020-0
* Einführung in die Elektrotechnik
  Jötten, Zürneck
  Uni-Text, Vieweg Verlag
* Grundlagen der Elektrotechnik
  Phillipow,
  Hüthig Verlag
* Theoretische Elektrotechnik
  Simonyi,
  Deutscher Verlag der Wissenschaften


Responsible for Module:
Witzmann, Rolf; Prof. Dr.-Ing.

Courses (Type of course, Weekly hours per semester), Instructor:
Electrical Engineering (LB-BF-MT) (lecture with integrated exercises, 3 SWS)
Würl T [L], Witzmann R, Würl T

For further information in this module, please click campus.tum.de or here.
Module Description

El29821: Principles of Information Engineering

TUM School of Management

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<tr>
<th>Module Level:</th>
<th>Language:</th>
<th>Duration:</th>
<th>Frequency:</th>
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<tbody>
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<td>Bachelor</td>
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<td>one semester</td>
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</tr>
<tr>
<td>5</td>
<td>150</td>
<td>90</td>
<td>60</td>
</tr>
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</table>

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:


Repeat Examination:
Next semester

(Recommended) Prerequisites:
Grundlegende (Schul-)kenntnisse der Algebra und der Integralrechnung.

Content:


Intended Learning Outcomes:
Durch die Teilnahme an den Modulveranstaltungen erhalten die Studierenden Grundkenntnisse in ausgewählten Themengebieten der Informationstechnik. Sie haben die Fähigkeit, auf den behandelten Themenfeldern grundlegende Aufgaben der Schaltungsentwicklung und Schaltungs- bzw. Signalanalyse durchzuführen.

Teaching and Learning Methods:


Als Lehrmethode wird in der Vorlesungen und Übungen Frontalunterricht gehalten, in den Übungen auch Arbeitsunterricht (Aufgaben rechnen).
**Media:**
Folgende Medienformen finden Verwendung:
- Präsentationen
- Skript
- Übungsaufgaben mit Lösungen als Download im Internet

**Reading List:**
Skriptum zur Vorlesung, erhältlich in FSEI

**Responsible for Module:**
Hanik, Norbert; Prof. Dr.-Ing.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Grundlagen der Informationstechnik (LB) (lecture, 4 SWS)
Hanik N, Kernetzky K

For further information in this module, please click campus.tum.de or here.
Module Description

El2986: Telecommunication I - Signal Representation

TUM School of Management

Module Level: Bachelor  
Language: German  
Duration: one semester  
Frequency: winter semester

Credits:*  
Total Hours: 150  
Self-study Hours: 105  
Contact Hours: 45

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:


Repeat Examination:

Next semester

(Recommended) Prerequisites:

Grundlegende Kenntnisse der Differential- und Integralrechnung.

Content:


Intended Learning Outcomes:

Durch die Teilnahme an den Modulveranstaltungen erhalten die Studierenden fundierte Kenntnisse der der Fourier-Reihenentwicklung und Fourier-Transformation eindimensionaler Signale sowie der Analyse linearer Systeme mit Methoden der linearen Systemtheorie. Sie haben die Fähigkeit, lineare zeitinvariente Systeme im Zeit- und Frequenzbereich zu analysieren und auftretende Störungen zu berechnen und zu bewerten.

Teaching and Learning Methods:

**Media:**
Folgende Medienformen finden Verwendung:
- Präsentationen
- Skript
- Übungsaufgaben mit Lösungen als Download im Internet

**Reading List:**
Skriptum zur Vorlesung, erhältlich in FSEI

**Responsible for Module:**
Hanik, Norbert; Prof. Dr.-Ing.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Telecommunications I (LB) (lecture with integrated exercises, 3 SWS)
Hanik N

For further information in this module, please click campus.tum.de or here.
Module Description

IN8005: Introduction into Computer Science (for non Informatics studies)

TUM School of Management

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<tr>
<th>Module Level:</th>
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<th>Frequency:</th>
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<tbody>
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<td>Bachelor</td>
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<tr>
<td>5</td>
<td>150</td>
<td>90</td>
<td>60</td>
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</table>

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Type of Assessment: written exam (90 minutes)
The exam takes the form of written test. Knowledge questions allow to assess acquaintance with and understanding of the basic concepts of Computer Science. Small programming and modelling problems allow to assess the ability to practically apply the learned programming- and query-languages and modelling-techniques for the solution of small problems.

Homework will be scored and upon achieving a minimum required number of points, a 0.3 bonus for the final grade is granted.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Recommended requirements are Mathematics modules of the first year of the TUM-BWL bachelor's program as well as the module WI000275 'Management Science'.

Content:
The module IN8005 is concerned with topics such as:
- Database Management Systems, ER models, Relational Algebra, SQL
- Java as a programming language:
  ++ basic constructs of imperative programming (if, while, for, arrays etc.)
  ++ object-oriented programming (inheritance, interfaces, polymorphism etc.)
  ++ basics of Exception Handling and Generics
  ++ code conventions
  ++ Java class library
- Basics of Visual Basic for Applications
- Basic algorithms and data structures:
  ++ algorithm concept, complexity
  ++ data structures for sequences (arrays, doubly linked lists, stacks & queues)
  ++ recursion
  ++ hashing (chaining, probing)
  ++ searching (binary search, balanced search trees)
  ++ sorting (Insertion-Sort, Selection-Sort, Merge-Sort)

Intended Learning Outcomes:
Upon successful completion of the module, participants understand important foundations, concepts and ways of thinking of Computer Science, in particular object-oriented programming, databases and SQL, and basic algorithms and data structures, have an overview over these topics and be able use them for the development of
own programs with a link to a database in a basic way.

**Teaching and Learning Methods:**
Lecture and practical tutorial assignments. A central tutorial deepens the understanding of the concepts introduced in the lecture using example assignments in regard to being able to solve given problems. In the tutorials, the students solve basic assignments under intensive supervision, which contributes to providing them with the basic skills in programming, in order to be able to apply the knowledge acquired by self-study of the accompanying materials of lecture and central tutorial for autonomously solving the programming assignments of the homework. During the second half of the semester, the students work on a small practical project, which aims at deepening the connected understanding of the desired learning outcomes. Programming aspects of this project are distributed over tutorial and homework assignments and are aligned with the topics of the respective week.

**Media:**
Slides, blackboard, lecture- and central tutorial recording, discussion boards in suitable e-learning platforms

**Reading List:**
Chapters from textbooks, which are closely associated with the module content and are provided to the students online.

**Responsible for Module:**
Seidl, Helmut; Prof. Dr.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Introduction into Computer Science (for non Informatics studies, TUM BWL) (IN8005) (lecture, 2 SWS)
Groh G

Exercise Session for Introduction into Computer Science (for non Informatics studies, TUM BWL) (IN8005) (exercise, 2 SWS)
Groh G [L], Dall'Olio G, Groh G, Steinberger C

For further information in this module, please click campus.tum.de or here.
Module Description

MA9714: Mathematics in Natural and Economic Science 2 [MBNW 2]

Mathematik II
TUM School of Management

Module Level: Bachelor
Language: English
Credits:* 6

Duration: one semester
Self-study Hours: 120

Frequency: summer semester
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The module examination is based on a written exam (90 minutes). Students have to show their knowledge of basic concepts to solve ordinary differential equations and eigenvalue problems and to compute multiple and line integrals. They are able to apply these concepts in problems of natural sciences.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
The following module must be successfully completed prior to participation: MA9711 Mathematics in Natural and Economic Science 1.
Recommended: MA9712 Statistics for BWL.

Content:
ordinary differential equations (initial value problems), vector calculus (area and volume integrals, theorem of Fubini, coordinate transformations, polar, spherical and cylindrical coordinates, curves, path integrals, potential functions, div and curl, integrability, theorems of Gauss and Stokes), advanced linear algebra (eigenvalue problems)

Intended Learning Outcomes:
After attending this module students understand important basic concepts in the realm of ordinary differential equations, eigenvalue problems, double, triple and path integrals and are able to solve equations and other problems from these areas independently.

Teaching and Learning Methods:
The module consists of a series of lectures supplemented by exercise sessions. In the lectures, theoretical principles and examples are presented. In the exercise sessions, problems which illustrate and deepen the topics of the lectures are discussed. Optionally, additional exercise classes can be offered in which students work on problems, either independently or guided by mentors, and preferably in teamwork.

Media:
Following media are used:
- presentations
- assignments including solutions as download
Reading List:

Responsible for Module:
Schulz, Andreas; Prof. Dr. rer. nat.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.
Elective Modules Electrical Engineering and Information Technology
Module Description

EI0602: Audio Communication

TUM School of Management

**Module Level:** Bachelor  
**Language:** German  
**Duration:** one semester  
**Frequency:** summer semester

**Credits:** 5  
**Total Hours:** 150  
**Self-study Hours:** 105  
**Contact Hours:** 45

Number of credits may vary according to degree program. Please see Transcript of Records.

**Description of Examination Method:**
Das Verständnis und die Fähigkeit zur individuellen Problemlösung werden in einer 60-minütigen schriftlichen Prüfung evaluiert, in der Rechenaufgaben zu Akustikgrundlagen, beispielsweise anhand von Schallwändern, zu lösen sind und weiterführende Fragen zu Aspekten der Hörrahmehmung beantwortet werden sollen. Studierende weisen so die Fähigkeit zu Berechnungen in der Akustik und das Verständnis der Hörrahmehmung nach.

**Repeat Examination:**  
Next semester

**(Recommended) Prerequisites:**
Mathematische Grundlagen (komplexe Rechnung), Grundlagen der Signalverarbeitung (Fouriertransformation)

**Content:**

**Intended Learning Outcomes:**

**Teaching and Learning Methods:**

**Media:**
Vorlesung mit akustischen Demonstrationen, (Tafel-)Anschrift, Umdrucke, Erläuterungen an Fallbeispielen,
multimedial Darbietung von weiterführender Information, Übung mit Fällen und Lösungen, vertiefende Information online zum Selbststudium

**Reading List:**

**Responsible for Module:**
Seeber, Bernhard; Prof. Dr.-Ing.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Audio Communication (lecture with integrated exercises, 3 SWS)
Seeber B, Beinstingel R, Kolotzek N

For further information in this module, please click [campus.tum.de](http://campus.tum.de) or [here](http://here).
**Module Description**

**El0644: Photovoltaic Stand Alone Systems  [PVI]**

TUM School of Management

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<th>Frequency:</th>
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<td>Bachelor</td>
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<tbody>
<tr>
<td>5</td>
<td>150</td>
<td>90</td>
<td>60</td>
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</table>

Number of credits may vary according to degree program. Please see Transcript of Records.

**Description of Examination Method:**

Im Rahmen einer 60 minütigen schriftlichen Klausur wird durch Beantworten von Wissensfragen und Modellrechnungen zur Auslegung von Anlagen überprüft, inwieweit Studierende die Eigenschaften und Einsatzbereiche von Inselsystemen wiedergeben können.

**Repeat Examination:**

Next semester

**(Recommended) Prerequisites:**

Keine speziellen Anforderungen

**Content:**

Die Vorlesung vermittelt die Grundlagen sowie Methoden zur Auslegung photovoltaischer Inselsysteme.

- Einführung
- Grundlagen Solarstrahlung
- Aufbau und Funktionsweise einer Solarzelle
- Elektrotechnische Ersatzschaltbilder
- Solarmodule / Solarsysteme/ Ersatzschaltbilder
- Energieertrag (Abhängigkeiten)
- Speicherproblematik und Speichertechnologien
- Speicherlösungen und deren Grenzen in photovoltaischen Anwendungen
- Betriebsstrategien
- Klassische Auslegung von photovoltaischen Inselsysteme
- Modellbasierte Auslegung
- Wirtschaftlichkeitsaspekte
- Hybridsysteme

**Intended Learning Outcomes:**

Die Teilnehmer verfügen nach erfolgreichem Abschluss des Moduls über grundlegende Kenntnisse photovoltaischer Inselsysteme und können die Auslegung dieser Systeme vornehmen, beispielsweise Solar Home Systeme, Dorfstromversorgungen und photovoltaische Kleingeräte.

**Teaching and Learning Methods:**

Als Lehrmethode wird in der Vorlesung Frontalunterricht, ergänzt durch Gruppendiskussionen, verwendet. Ferner sollen Exponate zur Veranschaulichung eingesetzt werden und einige Zusammenhänge werde auch mittels Animationen gezeigt.

**Media:**
Folgende Medienformen finden Verwendung:
- Präsentationen mit Laptop und Beamer
- Tafelanschrieb
- Diskussionen zu Fachaufsätzen und aktuellen Themen, wie Speicher in der Elektromobilität und Speicher für die Energiewende.

**Reading List:**
Allgemeine Literatur wird in der Vorlesung bekannt gegeben. Es werden verschiedene Zeitschriftenbeiträge online zur Verfügung gestellt, die dann auch in der Vorlesung diskutiert werden.

**Responsible for Module:**
Jossen, Andreas; Prof. Dr.-Ing.

**Courses (Type of course, Weekly hours per semester), Instructor:**

For further information in this module, please click [campus.tum.de](http://campus.tum.de) or [here](http://example.com).
Specialization in Technology: Mechanical Engineering

If students choose the specialization in technology Mechanical Engineering, they must earn 37 credits from required modules and a minimum of 5 credits from an elective module. Below is a sample catalog of elective modules.
Required Modules Mechanical Engineering
Module Description

**BV350007: Materials in Mechanical Engineering**

TUM School of Management

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<tbody>
<tr>
<td>Bachelor</td>
<td>German</td>
<td>one semester</td>
<td>summer semester</td>
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</table>

**Credits:** 6

**Total Hours:** 180

**Self-study Hours:** 120

**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

**Description of Examination Method:**
Students are assessed in a 90-minute written examination. In the written examination students are required to demonstrate their ability to describe concisely, general basic technical knowledge of materials, the specific properties of metals, polymers and ceramic materials and are able to transfer them into practice, as well as the ability to solve arithmetic problems concerning important material-specific properties under time pressure. Apart from a non-programmable pocket calculator, no aids are allowed.

**Repeat Examination:**
Next semester

**(Recommended) Prerequisites:**
o

**Content:**
The lecture teaches about the chemical and physical principles of materials. The materials concerned are steel, non-ferrous metals, thermoplastics, duroplastics, elastomers, ceramics, glass, cement and concrete. Furthermore, the topics of load-dependent and load-independent deformation properties, stress-strain diagrams and strengths in general are discussed. Apart from the mechanical material properties, the production and durability of the materials are also covered. One focal aspect is the topic of material corrosion.

**Intended Learning Outcomes:**
At the end of the module the students are able to describe the most important materials and to differentiate between them by way of their characteristic properties. They are able to link the material properties to the elementary structure of the materials. They are also able to select a suitable material for a given requirements profile.

Students also acquire competence in describing and selecting relevant tests for the material properties and depending on the material property to be examined as well as analysing test results statistically and evaluating them on the basis of the material requirements.

Targeted case studies should strengthen student's abstraction ability and their skill in transferring that which they have learned to a new problem area.

**Teaching and Learning Methods:**
In this course the main teaching content is basically taught in the form of a classic lecture with continuous support in the form of a PowerPoint presentation. Particular detailed aspects or aspects important for overall understanding are derived gradually by writing on the board and are explained graphically. This procedure enables students to receive clear and clearly legible presentation of the content and promotes concentrated listening, and therefore the understanding of the students, as they are not diverted by having to continuously write down what is written on the
board. The lecture material is examined in greater depth through regular, brief exercises adjusted to the progress of the lecture, which enables optimum implementation of the lecture content.

**Media:**
PowerPoint-presentation, overhead projector, board, experiments, video

**Reading List:**
- Roos, E; Maile, K.: Werkstoffkunde für Ingenieure. Springer 2005
- Schneider, J.: Sicherheit und Zuverlässigkeit im Bauwesen. www.vdf.ethz.ch
- Henning/Knöfel: Baustoffchemie. Verlag Bauwesen 2002
- Skriptum zu Vorlesung Baustoffkenngrößen, Bauchemie, Konstruktionswerkstoffe Teil III

**Responsible for Module:**
Dr.-Ing. D. Lowke: mailto: lowke@tum.de
Dr.-Ing. K. Osterminski mailto: kai.osterminski@tum.de

**Courses (Type of course, Weekly hours per semester), Instructor:**

For further information in this module, please click campus.tum.de or here.
Module Description

IN8005: Introduction into Computer Science (for non Informatics studies)

TUM School of Management

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<th>Language:</th>
<th>Duration:</th>
<th>Frequency:</th>
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<tbody>
<tr>
<td>Bachelor</td>
<td>English</td>
<td>one semester</td>
<td>winter semester</td>
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</tbody>
</table>

Credits:* Total Hours: Self-study Hours: Contact Hours:
5 150 90 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Type of Assessment: written exam (90 minutes)
The exam takes the form of written test. Knowledge questions allow to assess acquaintance with and understanding of the basic concepts of Computer Science. Small programming and modelling problems allow to assess the ability to practically apply the learned programming- and query-languages and modelling-techniques for the solution of small problems.
Homework will be scored and upon achieving a minimum equired number of points, a 0,3 bonus for the final grade is granted.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Recommended requirements are Mathematics modules of the first year of the TUM-BWL bachelor's program as well as the module WI000275 'Management Science'.

Content:
The module IN8005 is concerned with topics such as:
- Database Management Systems, ER models, Relational Algebra, SQL
- Java as a programming language:
  ++ basic constructs of imperative programming (if, while, for, arrays etc.)
  ++ object-oriented programming (inheritance, interfaces, polymorphism etc.)
  ++ basics of Exception Handling and Generics
  ++ code conventions
  ++ Java class library
- Basics of Visual Basic for Applications
- Basic algorithms and data structures:
  ++ algorithm concept, complexity
  ++ data structures for sequences (arrays, doubly linked lists, stacks & queues)
  ++ recursion
  ++ hashing (chaining, probing)
  ++ searching (binary search, balanced search trees)
  ++ sorting (Insertion-Sort, Selection-Sort, Merge-Sort)

Intended Learning Outcomes:
Upon successful completion of the module, participants understand important foundations, concepts and ways of thinking of Computer Science, in particular object-oriented programming, databases and SQL, and basic algorithms and data structures, have an overview over these topics and be able use them for the development of
own programs with a link to a database in a basic way.

**Teaching and Learning Methods:**
Lecture and practical tutorial assignments. A central tutorial deepens the understanding of the concepts introduced in the lecture using example assignments in regard to being able to solve given problems. In the tutorials, the students solve basic assignments under intensive supervision, which contributes to providing them with the basic skills in programming, in order to be able to apply the knowledge acquired by self-study of the accompanying materials of lecture and central tutorial for autonomously solving the programming assignments of the homework. During the second half of the semester, the students work on a small practical project, which aims at deepening the connected understanding of the desired learning outcomes. Programming aspects of this project are distributed over tutorial and homework assignments and are aligned with the topics of the respective week.

**Media:**
Slides, blackboard, lecture- and central tutorial recording, discussion boards in suitable e-learning platforms

**Reading List:**
Chapters from textbooks, which are closely associated with the module content and are provided to the students online.

**Responsible for Module:**
Seidl, Helmut; Prof. Dr.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Introduction into Computer Science (for non Informatics studies, TUM BWL) (IN8005) (lecture, 2 SWS)
Groh G

Exercise Session for Introduction into Computer Science (for non Informatics studies, TUM BWL) (IN8005) (exercise, 2 SWS)
Groh G [L], Dall'Olio G, Groh G, Steinberger C

For further information in this module, please click campus.tum.de or here.
Module Description

MA9714: Mathematics in Natural and Economic Science 2  [MBNW 2]

Mathematik II
TUM School of Management

Module Level: Bachelor
Language: English
Credits:* 6

Total Hours: 180
Self-study Hours: 120
Contact Hours: 60

Duration: one semester
Frequency: summer semester

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The module examination is based on a written exam (90 minutes). Students have to show their knowledge of basic concepts to solve ordinary differential equations and eigenvalue problems and to compute multiple and line integrals. They are able to apply these concepts in problems of natural sciences.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
The following module must be successfully completed prior to participation: MA9711 Mathematics in Natural and Economic Science 1.
Recommended: MA9712 Statistics for BWL.

Content:
ordinary differential equations (initial value problems), vector calculus (area and volume integrals, theorem of Fubini, coordinate transformations, polar, spherical and cylindrical coordinates, curves, path integrals, potential functions, div and curl, integrability, theorems of Gauss and Stokes), advanced linear algebra (eigenvalue problems)

Intended Learning Outcomes:
After attending this module students understand important basic concepts in the realm of ordinary differential equations, eigenvalue problems, double, triple and path integrals and are able to solve equations and other problems from these areas independently.

Teaching and Learning Methods:
The module consists of a series of lectures supplemented by exercise sessions. In the lectures, theoretical principles and examples are presented. In the exercise sessions, problems which illustrate and deepen the topics of the lectures are discussed. Optionally, additional exercise classes can be offered in which students work on problems, either independently or guided by mentors, and preferably in teamwork.

Media:
Following media are used:
- presentations
- assignments including solutions as download
Reading List:

Responsible for Module:
Schulz, Andreas; Prof. Dr. rer. nat.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.
Module Description

MW1108: Engineering Mechanics for Technology Management [TM TUM BWL]

TUM School of Management

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<th>Module Level:</th>
<th>Language:</th>
<th>Duration:</th>
<th>Frequency:</th>
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<tr>
<td>Bachelor</td>
<td>German</td>
<td>one semester</td>
<td>winter semester</td>
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</table>

Credits:*  | Total Hours:  | Self-study Hours: | Contact Hours: |
| 6           | 180        | 135         | 45          |

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
In a 120-minute written examination, the understanding of the imparted principles and techniques of engineering mechanics is tested by application of them on various problems. These calculation problems are similar in the style to the exercises, where the students are intended to analyse, to systematically tackle and to solve the tasks included.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Good knowledge in applied mathematics. Recommended courses: "Mathematische Behandlung der Natur- und Wirtschaftswissenschaften 1+2" or "Höhere Mathematik"

Content:
Basic principles of statics, elastostatics and kinetics: force, moment (torque), equilibrium, method of sections, center of mass, energy and stability, stress and strain, elastic constitutive law, Mohr's circle, (Euler-Bernoulli) beam theory, area moments of inertia, kinematics and kinetics of particles, impact, vibrations.

Intended Learning Outcomes:
After successful participation the students are able to
- apply terminology, principles and techniques of engineering mechanics
- analyse, tackle and solve new problems out of the covered fields
- create self-dependently particular knowledge in the field of engineering mechanics on the basis of the conveyed fundamentals
- understand subsequent lectures at the faculty of mechanical engineering
- create a level of comunication with engineers in their daily professional life.

Teaching and Learning Methods:
The module consists of a lecture including exercises as well as a tutorial in small groups on a weekly basis. The lecture includes several teaching methods such as presentations, animations, short films and the usage of a blackboard. The current subject matter is repeated in tutorials and further examples are exercised. All teaching and exercise material as well as proposals for solutions and further information can be downloaded from the E-Learning platform.

Media:
Presentations, blackboard.
Documents via E-Learning platform.

**Reading List:**
Gross - Hauger - Schnell: Technische Mechanik 1, Springer Verlag
Gross - Hauger - Schröder - Wall: Technische Mechanik 2, Springer Verlag
Hauger - Schnell - Gross: Technische Mechanik 3, Springer Verlag
Wriggers - Nackenhorst - Beuermann - Spiess - Löhnert: Technische Mechanik kompakt, Springer-Vieweg-Verlag

**Responsible for Module:**
Werner, Ewald; Prof. Dr.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Engineering Mechanics for Technology Management - Exercises (exercise, 1 SWS)
Werner E [L], Krempaszky C ( Jahn Y )

Engineering Mechanics for Technology Management (lecture, 2 SWS)
Werner E [L], Krempaszky C ( Jahn Y )

Engineering Mechanics for Technology Management - Group Exercises (exercise, 2 SWS)
Werner E [L], Krempaszky C ( Jahn Y )

For further information in this module, please click
[campus.tum.de](http://campus.tum.de) or [here](http://here).
Module Description

**MW1694: Machine Elements - Basics, Manufacturing, Application  [ME-BMA]**

TUM School of Management

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<th>Module Level:</th>
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<th>Duration:</th>
<th>Frequency:</th>
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<tr>
<td>Bachelor</td>
<td>German</td>
<td>one semester</td>
<td>winter semester</td>
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</table>

Credits:*    | Total Hours: | Self-study Hours: | Contact Hours: |
7             | 210          | 135            | 75             |

Number of credits may vary according to degree program. Please see Transcript of Records.

**Description of Examination Method:**

**Repeat Examination:**
Next semester

**(Recommended) Prerequisites:**
Grundlagen der Produktion, Maschinenzeichnen und elastostatische Mechanik

**Content:**

**Intended Learning Outcomes:**
Nach der Teilnahme an den Modulveranstaltungen sind die Studierenden in der Lage grundlegende Zusammenhänge von Maschinenelementen zu verstehen und zu bewerten.
Sie können:
- Normen anwenden, Toleranzen und Passungen entwickeln sowie Oberflächengüten bewerten
- Statische Festigkeitsnachweise anwenden
- Stoffschlüssige Verbindungen, wie z.B. Schweißen, Löten, Kleben und Nieten bewerten.
- Schraub- und Welle-Nabe-Verbindungen entwickeln
- Gestaltungsrichtlinien in der Konstruktion anwenden
- Paarungen und Lager analysieren
- Getriebe verstehen
- Schmierungen und Dichtungen erinnern
Teaching and Learning Methods:

Media:
Präsentation, Filme

Reading List:

Responsible for Module:
Zäh, Michael; Prof. Dr.-Ing.

Courses (Type of course, Weekly hours per semester), Instructor:
Machine Elements and Manufacturing (lecture, 2 SWS)

Machine Elements and Manufacturing (exercise, 3 SWS)
Zhao X, Zäh M, Busch M, Ellinger J, Meyer S, Sigl M

For further information in this module, please click campus.tum.de or here.
Module Description

MW2385: CAD and Machines Drawing (Specialization/Application Area) [CADundMZ]

TUM School of Management

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<th>Module Level:</th>
<th>Language:</th>
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<tbody>
<tr>
<td>Bachelor</td>
<td>German</td>
<td>two semesters</td>
<td>winter/summer semester</td>
</tr>
</tbody>
</table>

Credits:* | Total Hours: | Self-study Hours: | Contact Hours: |
5          | 150        | 45         | 105        |

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Das Lernergebnis im Modul CAD und Maschinenezeichnen wird durch zwei Modulteilprüfungen geprüft: eine Prüfungsleistung in Form einer schriftlichen Klausur mit einer Dauer von 90 Minuten, die regulär am Ende des Sommersemesters abgehalten wird und einer Studienleistung in Form einer Übungsleistung bestehend aus dem Anfertigen von technischen Zeichnungen und CAD Konstruktionsaufgaben.


Repeat Examination:
Next semester

(Recommended) Prerequisites:
Keine Voraussetzungen nötig. Da das Modul zweisemestrig ist, gelten die Lehrveranstaltungen im WiSe als Voraussetzung für die Lehrveranstaltungen im SoSe.

Content:
Die Vorlesung "Technisches Zeichnen" im WS vermittelt die Regeln des Technischen Zeichnens. Folgende Lehrinhalte werden vermittelt:
- Grundlagen der Zeichnungserstellung
- Darstellung eines Bauteils
- Bemaßung von Bauteilen

MW2385: CAD and Machines Drawing (Specialization/Application Area) [CADundMZ]
Generated on 11.03.2020

Das Praktikum "Skizzier- und Darstellungstechniken" im SS lehrt durch Bauteilaufnahmen die praktische Anwendung der Regeln des technischen Zeichens.

**Intended Learning Outcomes:**
Die Studierenden sind nach erfolgreichen Abschluss des Moduls CAD und Maschinenzeichnen (für TUM-BWL, TUM-Witec und IN) in der Lage,
- eine komplexe technische Zeichnung zu analysieren,
- den Zusammenhang von Bauteil- und Zusammenstellungszeichnungen zu analysieren,
- technische Zeichnungen und deren Auswirkungen hinsichtlich Fertigung, Kosten, etc. zu analysieren sowie diese unter Beachtung aller einschlägigen Richtlinien und Normen selbstständig anzufertigen (=schaffen),
- den Einfluss von verschiedenen Fertigungsverfahren auf die Gestaltung von Bauteilen zu bewerten,

**Teaching and Learning Methods:**
Die Vorlesungen des Moduls CAD und Maschinenzeichnen erfolgen als Frontalunterricht, ergänzend können die Inhalte im eLearning-Angebot selbst erarbeitet bzw. vertieft werden.

In den Zentralübungen werden die Inhalte der Vorlesung wiederholt und durch Übungsaufgaben angewendet. Die Studenten sind zur aktiven Mitarbeit aufgefordert.

Die Lernziele des Praktikums "CAD-Einführung" werden in der Gruppenarbeit nach dem Ansatz des problembasierten Lernens und des Arbeitsunterrichts vermittelt.

Das Praktikum "Skizzier- und Darstellungstechniken" ist als Arbeitsunterricht konzipiert, in dem die Studenten selbstorganisiert individuelle Aufgaben lösen müssen.

**Media:**
- Skripten zu allen Veranstaltungsteilen
- Präsentationen
- Übungsbilder
- Lehrvideos
- e-Learning
- Aufgaben und Lösungen

**Reading List:**
- Skripten des Lehrstuhls fml
- Unterlagen auf moodle-Plattform
**Responsible for Module:**
Fottner, Johannes; Prof. Dr.-Ing.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Technical Drawing and Introduction to CAD (practical training, 2 SWS)
Fottner J (Kessler S, Kleeberger M, Mitarbeiter W, Pfeiffer M, Rücker A, Tan Y)

CAD and Machines Drawing 1 (lecture, 1 SWS)
Fottner J (Kessler S, Pfeiffer M, Rücker A)

CAD and Machines Drawing 2 (lecture, 1 SWS)
Fottner J (Kessler S, Pfeiffer M, Rücker A)

CAD and Machines Drawing 1 / Practical Course (all students) (exercise, 1 SWS)
Fottner J (Pfeiffer M, Rücker A, Tan Y)

Technical Drawing and Introduction to CAD (exercise, 1 SWS)
Fottner J (Pfeiffer M, Rücker A, Tan Y)

CAD and Machines Drawing I / Practical hours, Tuesday (practical training, 1 SWS)
Rücker A [L], Fottner J, Pfeiffer M

For further information in this module, please click
[ campus.tum.de](http://campus.tum.de) or here.
Module Description

MW9006: Principles of Engineering Design and Production Systems  [GEP]

TUM School of Management

<table>
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<th>Module Level:</th>
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<th>Frequency:</th>
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<td>Bachelor</td>
<td>German</td>
<td>one semester</td>
<td>summer semester</td>
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<td>Credits:*</td>
<td>Total Hours:</td>
<td>Self-study Hours:</td>
<td>Contact Hours:</td>
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<td>3</td>
<td>90</td>
<td>45</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Für den Vorlesungsteil Grundlagen der Entwicklung und Produktion sind keine Vorkenntnisse erforderlich.

Content:

Intended Learning Outcomes:

Teaching and Learning Methods:

Media:
Präsentationen, Anschauungsmaterial, Skript
**Reading List:**

**Responsible for Module:**
Michailidou, Ioanna

**Courses (Type of course, Weekly hours per semester), Instructor:**
Principles of Engineering Design and Production Systems (lecture, 3 SWS)
Volk W (Eder M, Lechner P, Ott M), Zäh M (Kolb C), Zimmermann M (Hashemi Farzaneh H), Weuster-Botz D (Schädler T)

For further information in this module, please click campus.tum.de or here.
Elective Modules Mechanical Engineering
Module Description

MW1903: Bioprocess Engineering

TUM School of Management

Module Level: Bachelor
Language: German
Duration: one semester
Frequency: winter semester

Credits:* 5
Total Hours: 150
Self-study Hours: 105
Contact Hours: 45

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
In einer schriftlichen Klausur (Bearbeitungsduer 90 min, zugelassenes Hilfsmittel: Taschenrechner) sind die vermittelten Inhalte zu den Grundlagen der Bioverfahrenstechnik auf entsprechende Problemstellungen anzuwenden und auf weiterführende Aufgabenstellungen zu übertragen. Dadurch weisen die Studierenden nach, dass sie die Eigenschaften biotechnischer Verfahren verstehen und bewerten können wie beispielsweise die zu Grunde liegende Formalkinetik oder die Aufteilung biotechnologischer Prozesse in verschiedene Schritte.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Empfohlene Kenntnisse sind Grundlagen der Mathematik, Chemie und Biologie, wie sie in Bachelorstudiengängen an deutschen Hochschulen vermittelt werden.

Content:

Intended Learning Outcomes:
Nach der Teilnahme an dieser Modulveranstaltung haben die Studierenden grundlegende Kenntnisse der Bioverfahrenstechnik erworben und sind in der Lage, die wesentlichen Eigenschaften biotechnologischer Verfahren zu verstehen und zu bewerten. Die Studierenden sind in der Lage die der Bioreaktionstechnik zu Grunde liegende Formalkinetik zu erkennen und diese auf exemplarische Problemstellung anzuwenden. Ebenfalls sind die Studierenden in der Lage, zu erkennen, dass ein biotechnologischer Prozess mit Enzymen und Zellen aus einer Vielzahl verschiedener Schritte (Stoffumwandlung, Aufarbeitung, Steriltechnik, Analytik) besteht.

Teaching and Learning Methods:
In der Vorlesung werden mittels PowerPoint Folien die theoretischen Grundlagen der Bioverfahrenstechnik vermittelt. Wichtige Inhalte werden wiederholt aufgegriffen, um das Verständnis und die Bewertung der Eigenschaften biotechnologischer Verfahren zu stärken. Die Vorlesungsunterlagen werden den Studierenden auf geeignete Weise zur Verfügung gestellt. In der (zeitlich daran anschließenden) Übung werden Übungsauflagen vorbereitet und die Musterlösungen den Studierenden ebenfalls zur Verfügung gestellt. Damit und durch gezielte Fragen an den Übungsleiter haben die Studierenden die Möglichkeit ihr Verständnis zu vertiefen, um beispielsweise die der Bioreaktionstechnik zu Grunde liegende Formalkinetik sowie die Aufteilung...
biotechnologischer Prozesse in verschiedene Schritte zu erkennen.


**Media:**
Die in der Vorlesung verwendeten Folien werden den Studierenden in geeigneter Form rechtzeitig zugänglich gemacht. Übungsaufgaben werden regelmäßig verteilt und in der Regel werden die Musterlösungen eine Woche später ausgegeben und mit den Studierenden diskutiert.

**Reading List:**

**Responsible for Module:**
Weuster-Botz, Dirk; Prof. Dr.-Ing.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Bioprocess Engineering (lecture, 3 SWS)
Weuster-Botz D [L], Weuster-Botz D, Wolf L

For further information in this module, please click campus.tum.de or here.
Module Description

MW2156: Metal-cutting Manufacturing Processes [SFV]

TUM School of Management

<table>
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<th>Module Level:</th>
<th>Language:</th>
<th>Duration:</th>
<th>Frequency:</th>
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<td>Bachelor/Master</td>
<td>German</td>
<td>one semester</td>
<td>summer semester</td>
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<tbody>
<tr>
<td>5</td>
<td>150</td>
<td>90</td>
<td>60</td>
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</table>

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Die Prüfungsdauer beträgt 90 min und teilt sich in zwei Blöcke à 45 min. Der erste Block besteht aus einem Kurzfragen- und Berechnungsteil, im zweiten Block ist ein Arbeitsplan zu erstellen. Beide Blöcke sind in etwa gleich gewichtet. Hilfsmittel: Im Kurzfragen- und Berechnungsteil ist nur ein nicht-programmierbarer Taschenrechner erlaubt; eine Formelsammlung wird gestellt. Im Arbeitsplanungsteil sind alle Hilfsmittel erlaubt. "Normale" Wörterbücher sind erlaubt, elektronische Wörterbücher und Fachwörterbücher sind nicht erlaubt.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Lesen und Verstehen von technischen Zeichnungen

Content:
Zu Beginn der Vorlesung werden die Grundlagen der Zerspanungslehre (Kinematik, Schneidteilgeometrie, Spanbildung und Spanarten, Schnittkraftberechnung, Schneidstoffe) behandelt. Darauf aufbauend werden spanende Fertigungsprozesse mit geometrisch bestimmtmeter Schneide (Drehen, Fräsen, Sägen, Bohren, Räumen) und mit geometrisch unbestimmter Schneide (Schleifen, Honen, Läppen) sowie Verfahren zur Gewinde- oder Verzahnungsherstellung besprochen. Ein vergleichender Überblick über abtragende Fertigungsverfahren (Funkenerosion, Laserbearbeitung, Wasserstrahl- und Brennschneiden) schließt die Vorlesung ab. In den einzelnen Kapiteln werden zudem die entsprechenden Werkzeugmaschinen kurz vorgestellt.


Die Praxisrelevanz der vermittelten Inhalte wird im Rahmen einer Exkursion aufgezeigt.

Intended Learning Outcomes:
Nach der Teilnahme an den Modulveranstaltungen sind die Studierenden in der Lage:
- die Möglichkeiten und Grenzen der vorgestellten spanenden Fertigungsverfahren und der dazugehörigen Werkzeugmaschinen zu bewerten,
- spanende Fertigungsprozesse rechnerisch zu dimensionieren und
- die Fertigungsplanung inklusive Verfahrensauswahl anhand von technischen Zeichnungen durchzuführen.
Teaching and Learning Methods:
Vorlesung:
- Vorträge
- Präsentationen

Übung:
- Vorträge
- Präsentationen
- Gruppen- und Einzelarbeit

Media:

Reading List:
Empfohlene Literatur:
- Fischer: Tabellenbuch Metall, Europa Lehrmittel
- Dillinger; Doll: Fachkunde Metall, Europa Lehrmittel
- Hesser; Hoischen: Technisches Zeichnen, Cornelsen
- Degner; Lutze; Smejkal: Spanende Formung, Hanser

Responsible for Module:
Zäh, Michael; Prof. Dr.-Ing.

Courses (Type of course, Weekly hours per semester), Instructor:
Exercise Courses for Metal-cutting Manufacturing Processes (exercise, 1 SWS)
Zäh M, Fuchs C, Wimmer M

Metal-cutting Manufacturing Processes (lecture, 2 SWS)
Zäh M, Fuchs C, Wimmer M

For further information in this module, please click campus.tum.de or here.
Specialization in Technology: Computer Engineering

If students choose the specialization in technology Computer Engineering, they must earn a minimum of 42 credits from a catalog of elective modules.
Module Description

EI10001: Principles of Information Engineering  [PIE]

TUM School of Management

Module Level: Bachelor  Language: English  Duration: one semester  Frequency: summer semester
Credits:*  Total Hours: 180  Self-study Hours: 135  Contact Hours: 45

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The module examination is based on a written exam (75 minutes) which contains questions to assess the students' knowledge about the technical systems, e.g. information transmission systems, and their theoretical background, e.g. design principles, short mathematical problems to assess the students' mastering of the practiced mathematical concepts, and conceptual questions (e.g., about design principles or fundamental limitations) to assess the further intended learning outcomes. Up to 20% of the examination can be conducted in the form of multiple choice questions.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
The following module should be successfully completed prior to participation: MA9711 Mathematics in Natural and Economic Science 1.
The following module is recommended to be attended in parallel (if not already attended earlier): MA9712 Statistics for BWL.

Content:
* Fundamentals:
  - Elements of Stochastic Modeling and Analysis
  - Signals (analog/digital, deterministic/stochastic, real/complex)
  - The Frequency Domain (Fourier transform, spectrum and bandwidth, sampling theorem)
  - Information Theory (fundamentals, source coding, channel coding, channel capacity)
* Information Transmission and Storage Systems:
  - Elements of Data Transmission (transmission chain, filtering, modulation, detection)
  - Communication Systems (real systems compared to theory, channel models, performance criteria, comparison to data storage, current trends)
  - Communication Networks (network structures, interference, broadcast and multiple access, multihop and relaying, abstraction layers, network planning)
* Elements of Information Processing
  - Data Processing Devices (abstraction layers, real systems compared to theory, digital processing, algorithms and complexity)
  - Data Acquisition and Analysis (sampling and quantization, information and noise modeling, feature extraction, machine learning)
  - Security Aspects (reliability, security, secrecy, encryption)
Intended Learning Outcomes:
After attending the module, the students:
- can describe the main principles of operation of information transmission systems and networks as well as of data processing devices and methods
- are familiar with fundamental design principles of such systems and understand why existing systems are designed the way they are
- have an overview of the underlying physical and mathematical principles and can distinguish fundamental limitations from technological constraints
- have learned to take an engineering perspective on information transmission and processing tasks (e.g., by structuring a system into building blocks and abstraction layers)
- know the main mathematical methods relevant for this field of engineering and are able to apply a selection of these methods to example problems

Teaching and Learning Methods:
The module is designed for non-engineering students (in particular students in Management and Technology) who aim at understanding the fundamental principles and concepts of modern information transmission and processing. It consists of lectures, tutorials, and self-study.

In the lectures, both theoretical backgrounds and technical implementations are introduced and discussed. Mathematical concepts are introduced and explained as far as it is necessary for understanding the technical systems. The relevance of each of the considered topics is motivated by, e.g., press articles, teaser questions, or examples from daily life, and an additional reflexion at the end of each topic unit aims at conveying the engineering perspective on the considered problems and systems. New concepts are presented in a teacher-centered style and discussed in an interactive manner.

The aim of the tutorials is to repeatedly practice the application of the mathematical concepts as well as the ability to answer conceptual questions about the subject. The tutorials are held in a student-centered way, and problem sheets are provided.

Throughout the semester, short reading assignments may be given to the students, e.g., as an introduction to a new topic. In addition, the students are expected to recapitulate the lecture contents and to individually practice the exercises.

Media:
- Slide Presentations
- Blackboard (e.g., for mathematical details)
- Supporting documents (e.g., news articles, scientific publications) as downloads (reading assignments)
- Problem sheets as downloads

Reading List:
Recommendations and downloads are provided during the course separately for each topic.

Responsible for Module:
Utschick, Wolfgang; Prof. Dr.-Ing.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.
Module Description

EI10002: Principles of Electrotechnology [PiET]

TUM School of Management

Module Level: Bachelor
Language: English
Duration: one semester
Frequency: winter semester
Credits:* 6
Total Hours: 180
Self-study Hours: 120
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
This module will be assessed in a written final examination (90 min) after the teaching weeks. In this examination it is to verify that the candidates are able to understand the general principles of electrical engineering and to solve relevant problems in the fields covered in this module in a limited time and without any resources. The examination will cover all parts of the lectures and exercises.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Knowledge of electricity and magnetism on high school level.
Basic knowledge of vector analysis.

Content:
Electrostatics:
Electrical charges, Coulomb's law, electrostatic fields, electrostatic potentials and voltages.

Dielectric materials:
Polarisation, dielectric displacement vector, Gauß' law, capacitors and capacitances.

Stationary electrical currents:
Current densities, local and integral Ohm's law, Kirchhoff's laws, resistors and resistivities, electrical networks, voltage and current sources, equivalent circuits, electrical energy and power.

(Electro-)magnetism:
Fundamental terms in magnetism, magnetic dipoles, Dia-, Para-, Ferromagnetism, magnetising field, magnetic induction, Amperé's law, electromagnetic induction, Faraday's law, inductors and inductivities, transformers.

Intended Learning Outcomes:
After participating in the modules lectures and exercises, students are able to understand and apply the basic physical principles of electrical engineering. They have acquired basic knowledge and understanding of some of the underlying problem-solving methods of electrical engineering.

Teaching and Learning Methods:
Teaching methods in lectures and exercises: Lecture-style instructions mainly on the blackboard. In solving relevant exercises a deeper knowledge of the subject-matters presented in the lectures is sought.
Media:
The following media types are used in the lectures and exercises:
- Explanations and exemplifications on the black board, partly supplemented by computer-aided presentations.
- Downloads on the Internet.
- Exercises are provided with the objective that the students first should solve the problems independent by themselves, solution to the problems will be demonstrated in subsequent exercise sessions, and subsequently will be made available also via download on the Internet.

Reading List:
References will be presented in the first lecture hour.

Responsible for Module:
Schrag, Gabriele; Prof. Dr. rer. nat. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Principles in Electrotechnology (lecture, 3 SWS)
Wittmann F

Principles in Electrotechnology (exercise, 1 SWS)
Wittmann F [L], Hölzl W (Eßing S)

For further information in this module, please click campus.tum.de or here.
Module Description

EI10003: Analog Electronics [AE]

TUM School of Management

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<th>Module Level:</th>
<th>Language:</th>
<th>Duration:</th>
<th>Frequency:</th>
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<td>Bachelor</td>
<td>English</td>
<td>one semester</td>
<td>summer semester</td>
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<td>100</td>
<td>50</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
This module will be assessed in a written final examination (90 min) after the teaching weeks. In this examination it is to verify that the candidates are able to understand the general principles of analog electronic circuits and to solve simple but relevant problems in the fields covered in this module in a limited time and without any resources. The examination will cover all parts of the lectures and exercises of this module.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Subject matters as presented in the module "Principle of Electrotechnology"
Calculus; complex numbers and operations for ac signal analysis

Content:
Electronic signals
Circuit analysis (dc, ac)
Electrical characteristics of electronic devices
Electronic filters
Basics of semiconductor s physics
PN Junctions, pn diodes
Transistors
Basic Transistor circuits
Amplifiers

Intended Learning Outcomes:
After participating in the modules lectures and exercises, students are able to
- understand and apply the basic principles of analog electronic circuits
- have acquired basic knowledge and understanding of some of the basic problem-solving methods of electronic circuits.

Teaching and Learning Methods:
Teaching methods in the lectures and exercises: frontal teaching with presentations and on the blackboard. In solving relevant exercises a deeper knowledge of the subject matters of the lessons is sought.

Media:
The following media types are used in the lectures and exercises:
- Presentations (also for downloads on the Internet)
- Explanations and exemplifications on the black board
- Exercises are provided with the objective that the students first should solve the problems independent by themselves, the solutions to the problems will be demonstrated in subsequent exercise sessions, and subsequently will be made available also via download on the Internet.

Reading List:

**Responsible for Module:**
Schrag, Gabriele; Prof. Dr. rer. nat. habil.

**Courses (Type of course, Weekly hours per semester), Instructor:**

For further information in this module, please click [campus.tum.de](http://campus.tum.de) or [here](http://here).
Module Description

El5183: Control Theory (MSE)

TUM School of Management

<table>
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<tbody>
<tr>
<td>Bachelor</td>
<td>English</td>
<td>one semester</td>
<td>summer semester</td>
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</table>

Credits: 4

Total Hours: 120

Self-study Hours: 75

Contact Hours: 45

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The examination consists of a single written test at the end of the semester. The written examination is with closed book policy and no supporting material is allowed during the test. It consists of questions to determine the students' understanding of various concepts, e.g., Cayley-Hamilton theorem, singular value decomposition, stability, Lyapunov equations, controllability, observability, realization theory, state feedback, and state observers. The final exam is a written one that includes calculations, e.g. regarding the design of controllers, and its duration is 90 minutes.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge of differential equations and linear algebra are necessary.

Content:
Mathematical description of systems: state-space representations, existence and uniqueness theorems for ODEs, solutions of linear ODEs, matrix exponential, input-output description of continuous-time systems, transfer functions; Analysis of linear systems: stability, Lyapunov equations, controllability, observability; Realizations: realization theory, balanced realizations, minimum energy inputs, coprime fractions; Design of linear systems: state feedback, state observers, separation property, pole placement, tracking and disturbance rejection;

Intended Learning Outcomes:
Upon successful completion of the module, students are able to understand modeling of dynamical systems and their representations. They are able to analyse the model, its stability, controllability, and observability. Finally, they are able to design controllers enforcing some performance criterion on the model.

Teaching and Learning Methods:
Lecture is designed as an interactive session. The materials are covered step by step from scratch under the participation of the students. Several examples are exercised during each session with hand calculations on the blackboard so that students can deeply understand the covered materials.

Media:
Black board
(Possibly) Lecture Notes
Exercises with solutions as download
Reading List:

Responsible for Module:
Chakraborty, Samarjit; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.
Module Description

IN0003: Functional Programming and Verification

TUM School of Management

Module Level: Bachelor  
Language: German/English  
Duration: one semester  
Frequency: winter semester

Credits:*  
Total Hours: 150  
Self-study Hours: 90  
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The exam takes the form of a 120 minutes written test. Small programming tasks allow to assess whether the students master a functional programming language and are able to realize small implementation problems. By inferring simple invariants they demonstrate that they have understood the principles of program verification and are able to apply these.
The successful completion of homework assignments may contribute to the grade as a bonus. The exact details for this are announced timely at the begin of the lecture.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
IN0001 Introduction to Informatics 1

Content:
Among others, the module IN0003 is concerned with the following topics:
- Correctness of imperative programs  
  ++ Verification according to Floyd or Hoare  
  ++ Termination  
  ++ Procedures  
- Basic concepts of functional programming  
  ++ Values, variables, functions  
  ++ Data structures, pattern matching  
  ++ Higher order functions  
  ++ Polymorphic types  
  ++ Programming in the large: Structures and Functors  
  ++ Correctness of functional programs  
  +++ Semantics of functional programs  
  +++ Verification of functional programs

Intended Learning Outcomes:
After successful completion of the module, participants understand the key concepts of functional programming languages. They are able to solve well presented tasks in a functional programming language. Therefore, they are able to acquire programming skills on their own also in further functional programming languages. They also are familiar with the most important techniques for the verification of imperative and functional programming language and can apply them to simple programs.
Teaching and Learning Methods:
By means of a presentation, either by slides or whiteboard, the lecture transports the concepts of verification and the programming language and illustrates them by examples. Accompanying assignments for individual study deepen the understanding of the concepts explained in the lecture, and train students to apply these to the verification of small programs and to master programming in the given programming language.

Media:
Slide show, blackboard, possibly online programming and/or animations

Reading List:

 Responsible for Module:
Seidl, Helmut; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Functional Programming and Verification, Exercise Session (IN0003) (exercise, 2 SWS)
Nipkow T [L], Kappelmann K, Rädle J, Stevens L

Functional Programming and Verification (IN0003) (lecture, 2 SWS)
Kappelmann K, Nipkow T, Rädle J, Stevens L

For further information in this module, please click campus.tum.de or here.
Module Description

IN0006: Introduction to Software Engineering

TUM School of Management

<table>
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<tr>
<th>Module Level:</th>
<th>Language:</th>
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<th>Frequency:</th>
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<tbody>
<tr>
<td>Bachelor</td>
<td>German/English</td>
<td>one semester</td>
<td>summer semester</td>
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</table>

Credits:*  
Total Hours: 180  
Self-study Hours: 105  
Contact Hours: 75  

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Type of assessment: written exam

The exam takes the form of a 90 minutes written test. The examination consists of describing the main concepts and methods of each phase of the software engineering process. The students have to apply their knowledge to solve small problems. By means of modelling problems, the students have to show their ability to adequately analyze and evaluate given requirements.

Repeat Examination:  
End of Semester

(Recommended) Prerequisites:

IN0002 Fundamentals of Programming (Exercises & Laboratory)

Content:

Software engineering is the establishment and systematic use of engineering principles, methods, and tools for the division of work, the development and application of extensive, complex software systems. It deals with the production and development of software, the organization and modelling of data structures and objects, and the operation of software systems. Topics of the lecture include, among others:

- Modeling with UML
- Process models in software development (linear, iterative, agile)
- Requirements elicitation and analysis (functional model, dynamic model, and object model)
- System design (specification, software architecture, architectural patterns, and design goals)
- Object design and implementation (reuse, design patterns, and interface specification)
- Testing (component test, integration test, and system test)
- Configuration management, build management, and release management
- Software maintenance and evolution
- Project organization and communication

Intended Learning Outcomes:

After successful completion of this module, students are familiar with the basic concepts and methods of the different phases of a project, e.g. modeling the problem, reuse of classes and components, and delivery of the software. They have the ability to select and apply suitable concepts and methods for concrete problems.

The students know the most important software engineering terms and workflows and are able to analyze and evaluate given problems. In addition, students can solve concrete problems in software engineering, e.g. with the help of design patterns.
**Teaching and Learning Methods:**
By means of a slide presentation with animations, the interactive lecture introduces the basic concepts and methods of software engineering and explains them using examples. Small exercises, e.g. quizzes, modelling, and programming tasks, with individual feedback help students to identify whether they have understood the basic concepts and methods. Accompanying tutorials deepen the understanding of the concepts explained in the lecture by means of suitable group exercises and show the application of the different methods with the help of manageable problems in the different phases of software engineering. Homework enables students to deepen their knowledge in self-study. The presentation of the own solution in the accompanying tutorials improves communication skills, which are essential in software engineering. Individual feedback on homework allows students to measure learning progress and improve their skills.

**Media:**
Lecture with digital slides, livestream, online exercises (programming, modeling, quiz) with individual feedback, discussion forum and communication platform for the exchange between instructors, tutors, and students

**Reading List:**

**Responsible for Module:**
Matthes, Florian; Prof. Dr. rer. nat.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Introduction to Software Engineering (IN0006) (lecture, 3 SWS)
Brügge B [L], Krusche S, von Frankenberg und Ludwigsdorff N, Bernius J

For further information in this module, please click campus.tum.de or here.
Module Description

IN2113: Programming Languages

TUM School of Management

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<td>150</td>
<td>90</td>
<td>60</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The assessment is by means of a written exam of 90 minutes. Individual assignments assess in how far students are able to reproduce the complex semantical behaviors small example programs. Their knowledge and practical skills concerning programming constructs is further assessed by assignments which ask to simulate programming language constructs of one kind by programming language constructs of another kind. The successful 15-minute presentation of a further topic related to the lecture may contribute to the grad as a 0.3 bonus.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
IN0001 Introduction to Informatics 1, IN0002 Fundamentals of Programming (Exercises AAA Laboratory), IN0003 Introduction to Informatics 2, at least one programming language.

Content:
This lecture provides background information on various programming language concepts as they are provided in popular programming languages. Topics may include, among others:
- Generics
- Types
- Inheritance and delegation
- Garbage collection
- concurrency
- Meta programming

Intended Learning Outcomes:
Participants know about the various programming language constructs and their meanings. They are able to compare different language based approaches, to discuss their relative merits and potential work-arounds, if particular language features are missing.

Teaching and Learning Methods:
By means of a presentation, either by slides or whiteboard, the lecture presents fundamental concepts of programming languages and illustrates these by means of small examples. Accompanying assignments for individual study deepen the understanding of the concepts explained in the lecture, train students to apply the learnt concepts in implementations and develop the skill to to simulate the effect of missing language features by others.
Media:
Slide show, blackboard, online programming experiments, animations, lecture recording

Reading List:
Selected literature of the area and appropriate conference or journal papers

Responsible for Module:
Seidl, Helmut; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Exercise - Programming Languages (IN2113) (exercise, 2 SWS)
Löbel R

Programming Languages (IN2113) (lecture, 2 SWS)
Petter M

For further information in this module, please click campus.tum.de or here.
Module Description

IN2119: User Modeling and Recommender Systems

TUM School of Management

Module Level: Bachelor/Master
Language: English
Duration: one semester
Frequency: irregularly

Credits:* 5
Total Hours: 150
Self-study Hours: 150
Contact Hours: 0

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Type of Assessment: written exam

The exam takes the form of a 60 minutes written test. The exam assesses the acquaintance with and understanding of concepts, techniques and thinking in the area of user modeling and recommender systems. Using small problems, the exam allows to assess the ability to link and to apply this knowledge regarding the desired learning outcomes. The exam consists of free-text and multiple choice questions. During the semester, students are provided with (online) exercises that allow them to assess their learning progress and to prepare for the exam.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Recommended requirements are basic knowledge of computer science.

Content:
The module IN2119 is concerned with topics such as:
- Introduction to user modeling, user profile acquisition and management
- User modeling methods, e.g. Bayes networks
- Web document modeling and personalized web search
- Recommender systems principles
- Recommendation methods: collaborative, content-based and hybrid methods
- Additional issues of recommenders, e.g. group recommendation, context-aware and mobile recommenders
- Application areas for personalization, e.g. adaptive hypermedia
- Ubiquitous user modeling and adaptive mobile guides
- Evaluation of adaptive and recommendation systems
- Further issues, e.g. decision making and privacy

Intended Learning Outcomes:
After successful completion of this module, students will have a deeper understanding of the basic principles of user modeling and recommender systems. They can recognize challenges of different methods and have an overview of application areas. They understand the underlying methods, know their advantages and disadvantages and can apply the corresponding algorithms to (simple) examples.

Teaching and Learning Methods:
The lecture is conducted as E-Learning (videos lectures, reading assignments and online exercises), no presence sessions.
Media:
E-Learning material (videos, slides, reader), online exercises (eTests)

Reading List:
The course material contains further literature references.

Responsible for Module:
Ott, Jörg; Prof. Dr.-Ing.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.
Module Description

IN2161: Networks for Monetary Transactions

TUM School of Management

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<th>Module Level</th>
<th>Language</th>
<th>Duration</th>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The exam takes the form of a 60 minutes written test. In the written exam students should prove to be able to identify a given problem and find solutions within limited time.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:

Content:
Systemarchitektur (Hardware, Software)
Protokollschichten und Protokolle (eg. ISO 8583)
Sicherheitsarchitekturen und Sicherheitsstandards
Authorisierungslösungen und Signaturen
Arten von Attacken
Mobile Architekturen und deren Sicherheitskonzepte (OTA Services)
Anwendungen

Intended Learning Outcomes:
Verstehen und Einschätzen der Grundlagen, Architektur und Sicherheit von Netzwerken für den nationalen und internationalen Zahlungsverkehr sowie deren rechtliche Rahmenbedingungen

Teaching and Learning Methods:
Lecture

Media:
Slides

Reading List:
Claudia Eckert, IT Sicherheit: Konzepte-Verfahren-Protokolle, Oldenburg 2007
Lienemann, TCP/IP-Praxis, Heise 2003
Lepschies, Ecommerce und Hackerschutz, Vieweg 2000
Rankl, Effing Handbuch der Chipkarten, Hanser Verlag 2002
Pohlmann "Digitale Signatur für optimale Sicherheit", Hüthigverlag 1997
ZKA, Elektronisch cash im Umfeld von SEPA, 2006
Responsible for Module:
Baumgarten, Uwe; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Networks for Monetary Transactions (IN2161) (lecture, 2 SWS)
Sterzinger H, Baumgarten U

For further information in this module, please click campus.tum.de or here.
Module Description

IN2339: Data Analysis and Visualization in R

TUM School of Management

Module Level: Bachelor/Master
Language: English
Credits:* 6

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<tr>
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<td>90</td>
<td>90</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Written exam and project work:
The listed achievements, see Intended Learning Outcomes, are evaluated by one written exam of 90 min. There will be moreover two case studies, where the students must provide the source code that generates the report of an analysis of a given dataset. The analysis of this data covers all topics stated under Intended Learning Outcomes. The first case study covers topics 1-7. The second covers the topics 8-16. The final mark is the exam mark with bonus points for the two case studies.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:

R programming basics 1
R programming basics 2 (including report generation with R markdown)
Data importing
Cleaning and organizing data: Tidy data 1
Cleaning and organizing data: Tidy data 2
Base plot
Grammar of graphics 1
Grammar of graphics 2
Unsupervised learning (hierarchical clustering, k-means, PCA)
Case study I
Drawing robust interpretations 1: empirical testing by sampling
Drawing robust interpretations 2: classical statistical tests
Supervised learning 1: regression, cross-validation
Supervised learning 2: classification, ROC curve, precision, recall
Case study II

Intended Learning Outcomes:
At the end of the module students are able to:
- 1. produce scripts that automatically generate data analysis report
- 2. import data from various sources into R
- 3. apply the concepts of tidy data to clean and organize a dataset
- 4. decide which plot is appropriate for a given question about the data
- 5. generate such plots
- 6. know the methods of hierarchical clustering, k-means, PCA
- 7. apply the above methods and interpret their outcome on real-life datasets
- 8. know the concept of statistical testing
- 9. devise and implement resampling procedures to assess statistical significance
- 10. know the conditions of applications and how to perform in R the following statistical tests: Fisher test, Wilcoxon test, T-test.
- 11. know the concept of regression and classification
- 12 apply regression and classification algorithms in R
- 13. know the concept of error in generalization, cross-validation
- 14. implement in R a cross-validation scheme.
- 15. know the concepts of sensitivity, specificity, ROC curves
- 16. assess the latter in R

Teaching and Learning Methods:
Lecture provides the concept + programming exercises where these concepts are applied on data. The goal of each exercise is the generation of report documents.

Media:
Weekly posted exercises online, slides, live demo

Reading List:
An Introduction to Statistical Learning
with Applications in R  http://www-bcf.usc.edu/~gareth/ISL/
R for Data Science, by Garrett Grolemund and Hadley Wickham

Responsible for Module:
Gagneur, Julien; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Data Analysis and Visualization in R (IN2339) (lecture, 2 SWS)
Gagneur J [L], Gagneur J

Exercise Data Analysis and Visualization in R (IN2339) (exercise, 4 SWS)
Gagneur J [L], Gagneur J

For further information in this module, please click campus.tum.de or here.
Module Description

IN8005: Introduction into Computer Science (for non Informatics studies)

TUM School of Management

<table>
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<th>Module Level:</th>
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<th>Frequency:</th>
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<td>Bachelor</td>
<td>English</td>
<td>one semester</td>
<td>winter semester</td>
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Credits:*  
5  
Total Hours: 90
Self-study Hours: 60
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Type of Assessment: written exam (90 minutes)
The exam takes the form of written test. Knowledge questions allow to assess acquaintance with and understanding of the basic concepts of Computer Science. Small programming and modelling problems allow to assess the ability to practically apply the learned programming- and query-languages and modelling-techniques for the solution of small problems.

Homework will be scored and upon achieving a minimum required number of points, a 0.3 bonus for the final grade is granted.

Repeat Examination:  
End of Semester

(Recommended) Prerequisites:

Recommended requirements are Mathematics modules of the first year of the TUM-BWL bachelor's program as well as the module WI000275 'Management Science'.

Content:

The module IN8005 is concerned with topics such as:
- Database Management Systems, ER models, Relational Algebra, SQL
- Java as a programming language:
  ++ basic constructs of imperative programming (if, while, for, arrays etc.)
  ++ object-oriented programming (inheritance, interfaces, polymorphism etc.)
  ++ basics of Exception Handling and Generics
  ++ code conventions
  ++ Java class library
- Basics of Visual Basic for Applications
- Basic algorithms and data structures:
  ++ algorithm concept, complexity
  ++ data structures for sequences (arrays, doubly linked lists, stacks & queues)
  ++ recursion
  ++ hashing (chaining, probing)
  ++ searching (binary search, balanced search trees)
  ++ sorting (Insertion-Sort, Selection-Sort, Merge-Sort)

Intended Learning Outcomes:

Upon successful completion of the module, participants understand important foundations, concepts and ways of thinking of Computer Science, in particular object-oriented programming, databases and SQL, and basic algorithms and data structures, have an overview over these topics and be able use them for the development of
own programs with a link to a database in a basic way.

**Teaching and Learning Methods:**
Lecture and practical tutorial assignments. A central tutorial deepens the understanding of the concepts introduced in the lecture using example assignments in regard to being able to solve given problems. In the tutorials, the students solve basic assignments under intensive supervision, which contributes to providing them with the basic skills in programming, in order to be able to apply the knowledge acquired by self-study of the accompanying materials of lecture and central tutorial for autonomously solving the programming assignments of the homework. During the second half of the semester, the students work on a small practical project, which aims at deepening the connected understanding of the desired learning outcomes. Programming aspects of this project are distributed over tutorial and homework assignments and are aligned with the topics of the respective week.

**Media:**
Slides, blackboard, lecture- and central tutorial recording, discussion boards in suitable e-learning platforms

**Reading List:**
Chapters from textbooks, which are closely associated with the module content and are provided to the students online.

**Responsible for Module:**
Seidl, Helmut; Prof. Dr.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Introduction into Computer Science (for non Informatics studies, TUM BWL) (IN8005) (lecture, 2 SWS)
Groh G

Exercise Session for Introduction into Computer Science (for non Informatics studies, TUM BWL) (IN8005) (exercise, 2 SWS)
Groh G [L], Dall'Olio G, Groh G, Steinberger C

For further information in this module, please click campus.tum.de or here.
Module Description

IN8024: Information Management for Digital Business Models

TUM School of Management

<table>
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<th>Module Level:</th>
<th>Language:</th>
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<th>Frequency:</th>
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<tbody>
<tr>
<td>Bachelor</td>
<td>English</td>
<td>one semester</td>
<td>summer semester</td>
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Credits: 6

Total Hours: 180

Self-study Hours: 120

Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

The examination consists of a 90 minutes written exam. In the exam, students shall verify without auxiliary means that they are able to understand the fundamentals of information management, apply methods for the determination of information needs, evaluate the quality of information, and analyze models and methods of IM. Furthermore, it is verified that they are able to apply methods for cost estimation, understand the role of "information" as a resource in companies, analyze the relationship between IT and business strategy, and evaluate existing business models and create new business models. Furthermore, students shall verify that they are able to address a given scientific problem independently in the field of information management by writing a term paper.

Repeat Examination:

Next semester

(Recommended) Prerequisites:

None

Content:

The module "Information Management for Digital Business Models" covers the topics of management of information demand, supply, and usage, management of information systems (data, processes, application lifecycle), management of information and communication technology (storage, communication, processing, technology bundles), managerial functions of information management (IM organization, CIO, sourcing, business models, IM and strategy) and the role of information management in companies.

Intended Learning Outcomes:

At the end of the module "Information Management for Digital Business Models" students are able to understand the fundamentals of information management, apply methods for the determination of information needs, evaluate the quality of information, and analyze models and methods of IM. Furthermore, the students are able to apply methods for cost estimation, understand the role of "information" as a resource in companies, analyze the relationship between IT and business strategy, and evaluate existing business models and create new business models.

Teaching and Learning Methods:

The module consists of a lecture, an accompanying exercise and an empirical research part. Contents are taught in lecture and presentations. The Exercise addresses specific questions and exercises are completed in individual and/or group work with several learning activities including studying specialist literature and researching reference materials. The empirical research part includes participating and understanding empirical research projects as well as writing a scientific essay.
Media:
Overheads, PowerPoint, whiteboard, exercise sheets

Reading List:


Responsible for Module:
Krcmar, Helmut; Prof.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.
Module Description

**MA9714: Mathematics in Natural and Economic Science 2 [MBNW 2]**

*Mathematik II*
TUM School of Management

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<tr>
<td>6</td>
<td>180</td>
<td>120</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

**Description of Examination Method:**
The module examination is based on a written exam (90 minutes). Students have to show their knowledge of basic concepts to solve ordinary differential equations and eigenvalue problems and to compute multiple and line integrals. They are able to apply these concepts in problems of natural sciences.

**Repeat Examination:**
End of Semester

(Recommended) Prerequisites:
The following module must be successfully completed prior to participation: MA9711 Mathematics in Natural and Economic Science 1. Recommended: MA9712 Statistics for BWL.

**Content:**
onordinary differential equations (initial value problems), vector calculus (area and volume integrals, theorem of Fubini, coordinate transformations, polar, spherical and cylindrical coordinates, curves, path integrals, potential functions, div and curl, integrability, theorems of Gauss and Stokes), advanced linear algebra (eigenvalue problems)

**Intended Learning Outcomes:**
After attending this module students understand important basic concepts in the realm of ordinary differential equations, eigenvalue problems, double, triple and path integrals and are able to solve equations and other problems from these areas independently.

**Teaching and Learning Methods:**
The module consists of a series of lectures supplemented by exercise sessions. In the lectures, theoretical principles and examples are presented. In the exercise sessions, problems which illustrate and deepen the topics of the lectures are discussed. Optionally, additional exercise classes can be offered in which students work on problems, either independently or guided by mentors, and preferably in teamwork.

**Media:**
Following media are used:
- presentations
- assignments including solutions as download
Reading List:

Responsible for Module:
Schulz, Andreas; Prof. Dr. rer. nat.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.
Specialization in Technology: Renewable Resources

If students choose the specialization in technology Renewable Resources, they must earn 36 credits from required modules and a minimum of 6 credits from an elective module. Below is a sample catalog of elective modules.
Required Modules Renewable Resources
Module Description

CS0077: Fundamentals of Thermodynamics

TUM School of Management

Module Level: Bachelor
Language: German
Duration: one semester
Frequency: winter semester

Credits:* 6
Total Hours: 180
Self-study Hours: 120
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The module's graded examination requirement consists of a written exam. The students solve thermodynamical arithmetic problems and answer questions regarding the definitions and relations of thermodynamics. The students prove that they have understood the basic principles of thermodynamics by setting up and solving equations. Non-programmable calculators and a handed-out formulary are allowed aids. Exam duration: 90 minutes.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Mathematics (MA9711 Mathematics in Natural and Economic Science 1)

Content:
State variables, thermodynamic system, 1st and 2nd law of thermodynamics, equations of state for ideal gases and fluids of constant density, process cycles, efficiencies, phase diagrams of pure substances

Intended Learning Outcomes:
Upon successful completion of the module, students know the 1st and 2nd law of thermodynamics. They are able to apply thermal and caloric equations of state for ideal substance classes. They understand thermodynamic phenomena of phase change and related diagrams. The students can apply the ideal gas law and the 1st and 2nd law to technical problems.

Teaching and Learning Methods:
The module consists of a lecture and parallel tutorials. Contents of the lecture shall be imparted in speech and by presentation. To deepen their knowledge, students shall be encouraged to study the literature and reexamine the previous topics. In the exercises, skilled theory is directly applied to arithmetic examples as practical orientation.

Media:
Presentations, slide scripts, exercises, Moodle

Reading List:
P. STEPHAN, K. SCHABER, K. STEPHAN, F. MAYINGER: Thermodynamik, Band 1 Einstoffsysteme
**Responsible for Module:**
Prof. Jakob Burger

**Courses (Type of course, Weekly hours per semester). Instructor:**
Fundamentals of Thermodynamics (Exercise) (exercise, 2 SWS)
Burger J [L], Baumeister E, Burger J, Göttl Q, Voggenreiter J

Fundamentals of Thermodynamics (Lecture) (lecture, 2 SWS)
Burger J [L], Baumeister E, Burger J, Göttl Q, Voggenreiter J

For further information in this module, please click [campus.tum.de](http://campus.tum.de) or [here](http://here).
Module Description

WZS0001: Physics

TUM School of Management

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<th>Module Level:</th>
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<td>Bachelor</td>
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<td>one semester</td>
<td>winter semester</td>
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Credits:* 180  Total Hours: 120  Self-study Hours: 60  Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Achievement of desired learning objectives shall be verified in a written final exam (90 minutes). In this respect the students demonstrate that they know and understand the concepts of mechanics, thermal engineering, electricity and optics. By using specific physical issues (mainly computational tasks) the students demonstrate that they are able to also use acquired concepts in a solution-oriented way in simple cases.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Good A-level knowledge of mathematics

Content:
The module of physics provides an introduction into classical physics; it outlines the basics of mechanics, thermal engineering, electricity and optics. The module introduces into the math-based approach of physics for nature description.

Intended Learning Outcomes:
After participation of the module students can demonstrate physical basics. The students know the basic concepts of mechanics, thermal engineering, electricity and optics. Using examples students deepen in the exercise the application of this concepts to solve simple physical problems.

Teaching and Learning Methods:
Lecture (speech by teaching staff including writing on the board, PP media, books and other written material), exercise (self-employed work on exercises related to the topics of the lecture in small groups with tutors) for further practising of the concepts which were presented in the lecture.

Media:
Writing on the board, presentations, slide scripts

Reading List:
Paul A. Tipler: Physik (Physics), Spektrum (Panoply), Akademischer Verlag Heidelberg, Berlin, Oxford
Responsible for Module:
Josef Kainz

Courses (Type of course, Weekly hours per semester), Instructor:
Physics (Tutorial) (exercise, 2 SWS)
Kainz J [L], Härtl S, Kainz J, Lugauer F

Physics (Lecture) (lecture, 2 SWS)
Kainz J [L], Kainz J

For further information in this module, please click campus.tum.de or here.
Module Description

WZS0002: General and Inorganic Chemistry

TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The performance test will be in the form of a written examination rendered. The students should demonstrate in the exam the understanding of the structure of chemical compounds and their typical reactions and chemical conversions. It will also be tested the ability to formulate reaction equations, calculate reaction kinetic and thermodynamic parameters, as well as to transfer the acquired knowledge about the structure and reaction behavior of chemical substance groups to new chemical questions. No auxiliary means are allowed in the exam. 120 min examination time

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Knowledge of chemistry, mathematics and physics, which correspond to the basic course knowledge of the gymnasiale upper school

Content:
General principles of inorganic and physical chemistry: Atomic and molecular construction, structure of compounds, acid / base equilibria, redox reactions, thermodynamics, reaction kinetics and catalysis, fundamentals on electrochemistry, selected reactions of inorganic chemistry

Intended Learning Outcomes:
The students will know and understand the basic principles of chemical reactions and will be able to formulate correct reaction equations and simple reaction kinetic and thermodynamic calculations. Moreover, they will be able to apply the knowledge acquired with model reactions about chemical transformations of chemical substances and substance groups to answer new chemical questions. The successful participation in the module will enable the students to participate in the module of basic organic chemistry.

Teaching and Learning Methods:
Lectures and corresponding exercises with self analysis and workup of specific case studies. In relation to the teaching content exercise sheets are disbursed on which the students work in self-study before the tutorials. The solution and discussion takes place in the tutorials. At the postprocessing of the lecture especially while the exercises are solved the students keep themselves intensive busy with the teaching contents of the lecture and reach in this way a understanding of the structure and reaction behavior of chemical substance groups and practise the formulation of reaction equations.

Media:
Blackboard, presentation (using script), exercises.
Reading List:
1) Theodore L., H. Eugene LeMay, Bruce E. Bursten, Chemie Studieren Kompakt, 10. aktualisierte Auflage, Pearson Verlag, München;
2) Charles E. Mortimer, Ulrich Müller, Chemie, 10., überarbeitete Auflage, Thieme Verlag, Stuttgart

Responsible for Module:
Olga Garcia Machenio

Courses (Type of course, Weekly hours per semester), Instructor:
General and inorganic Chemistry (Lecture) (lecture, 2 SWS)
Riepl H [L], Karl R, Riepl H

General and inorganic Chemistry (Tutorial) (exercise, 2 SWS)
Riepl H [L], Riepl H

For further information in this module, please click campus.tum.de or here.
Module Description

WZS0003: Organic Chemistry

TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The performance test will be in the form of a written examination rendered. The students should demonstrate in the exam the understanding of the structure of organic chemical compounds and their typical reactions and chemical conversions. It will also be tested the ability to formulate reaction equations, as well as to transfer the acquired knowledge about the structure and reaction behavior of organic chemical substance groups to new chemical questions. No auxiliary means are allowed in the exam. 120 min examination time

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Knowledge of chemistry, mathematics and physics, which correspond to the basic course knowledge of the gymnasiale upper school

Content:
General principles of organic chemistry:
Structure of organic compounds, carbon-atom hybridization, important functional groups, nomenclature and structure of organic molecules, selected reactions of organic chemistry for important groups of substances including central natural substances.

Intended Learning Outcomes:
The students will know and understand the basic principles of organic chemical reactions and will be able to formulate correct organic reactions. Moreover, they will be able to apply the knowledge acquired with model reactions about chemical transformations of organic chemical substances and substance groups to answer new chemical questions.

Teaching and Learning Methods:
Lectures and corresponding exercises with self analysis and workup of specific case studies. In relation to the teaching content exercise sheets are disbursed on which the students work in self-study before the tutorials. The solution and discussion takes place in the tutorials. At the postprocessing of the lecture especially while the exercises are solved the students keep themselves intensive busy with the teaching contents of the lecture and reach in this way a understanding of the structure and reaction behavior of organic chemical substance groups and practise the formulation of reaction equations.

Media:
Blackboard, presentation (using script), exercises, laboratory equipment.
**Reading List:**
K.P.C. Vollhardt, N.E. Schore, Organische Chemie, Verlag VCH Weinheim

**Responsible for Module:**
Olga Garcia Mancheño

**Courses (Type of course, Weekly hours per semester), Instructor:**
Organic Chemistry (Lecture) (lecture, 2 SWS)
Zollfrank C

Organic Chemistry (Tutorial) (exercise, 2 SWS)
Zollfrank C [L], Zollfrank C

For further information in this module, please click [campus.tum.de](http://campus.tum.de) or [here](http://campus.tum.de).
Module Description

WZS0005: Forestry and Wood

TUM School of Management

Module Level: Bachelor
Language: German
Frequency: Winter semester

Credits:* 6
Total Hours: 180
Self-study Hours: 120
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Exam achievement shall be done in the form of a written test (exam duration: 90 minutes). Product pathways of timber harvest shall be reflected here. Classification of economic and ecological aspects of forestry from cultivation to harvesting shall be explained by using examples of particular cases. Recognition of wood and wood materials shall be shown. The relation of knowledge of the forest with regard to knowledge of different woods and wood utilisation will be evaluated at a ratio of 1 to 1. The answers require own formulations from the respective technical jargon of the timber industry.

Type of exam: In writing

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge in silviculture: Different thinning concepts. Location differences with their effects on selection of tree species.

Content:
The module aims at providing in-depth knowledge to the students in the field of timber harvest, from working methods to forest basics. Special emphasis is given to the interfaces concerning wood use (sawing, wood materials and paper industry) of energy wood production. The differences of farming systems of plantation, commercial forest, near-natural forest and the effect on biodiversity shall be shown. In a further aspect differences of woods shall be addressed from a microscopic point of view through to their field of application in the manufacturing industry. Silviculture as a result of climate change with new forms of cultivation such as short-rotation plantations and their combinations such as hedges, hedgerow substitution in the sense of agro-forestry models shall be presented. This also includes knowledge of by-products such as roadside planting as a raw material.

Intended Learning Outcomes:
After attending the module the student shall be able to characterise the product pathways in forestry especially for timber harvest. He will be able to represent forestry-related working methods. He distinguishes different forms of economy and is able to classify them according to economic, social and ecological aspects. He recognises differences of woods, knows various new products produced from wood and understands their production paths. He is able to mention by-products and their applications and use. He understands the main features of agro-forestry systems.

Teaching and Learning Methods:
The course attendance of forestry and wood consists of one lecture. For this purpose a powerpoint presentation shall be used. A study trip to a wood processing plant including lectures from qualified personnel providing
information from experience on site with common rounds of questions provides in-depth knowledge of the production paths. A so-called block determination, i.e. the determination of wood by means of different genuine wood samples, will be performed by a magnifying glass 10x.

Media:
Script, powerpoint, objects of wood and derived timber products. Study trip to a company with guided tour of processing and treatment of wood. Determination of wood with a magnifying glass 10x.

Reading List:
Sprache: Deutsch
ISBN-10: 3800155702
Holger Sohns, 2012: Moderne Holzverarbeitung. Ulmer Verlag
Michael Paulitsch und Marius C. Barbu, 2015: Holzwerkstoffe der Moderne. DRW Verlag

Responsible for Module:
Cordt Zollfrank (cordt.zollfrank@tum.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Forestry and Wood/Wood based Resources (Lecture) (lecture, 2 SWS)
Zollfrank C [L], Röder H, Zollfrank C

Forestry and Wood/Wood based Resources (Tutorial) (exercise, 2 SWS)
Zollfrank C [L], Röder H, Zollfrank C

For further information in this module, please click
 campus.tum.de or here.
Module Description

WZS0006: Introduction into Computer Science

TUM School of Management

Module Level: Bachelor  
Language: German  
Duration: one semester  
Frequency: summer semester

Credits:*  
Total Hours: 180  
Self-study Hours: 120  
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Exam achievement shall be done in the form of a written test (90 minutes). Knowledge questions check the treated basic concepts of computer science. Small programming and modelling tasks test the ability to apply the learned programming and query languages and the modelling techniques in order to solve simple problems.

Repeat Examination:  
Next semester

(Recommended) Prerequisites:  
Recommended prerequisites: Modules Mathematics I (TUM-BWL) and Management Science

Content:  
In the module following contents are treated exemplarily:
- database management systems, ER modelling, relational algebra and SQL
- Java as programming language:
  o Basic constructs of imperative programming ((if, while, for, arrays etc.)
  o Object-oriented programming ( inheritance, interfaces, polymorphism etc.)
  o Exception handling and generics basics
  o Code-Conventions
  o Java class library
- Basics of Visual Basic for Applications
- Basic algorithms and data structures:
  o Algorithm term, complexity
  o Data structures for sequences (linked lists, arrays, stacks & queues)
  o Recursion
  o Hashing (chaining, probing)
  o Search (binary search, balanced search trees)
  o Sorting (Insertion-sort, selection-sort, merge-sort)

Intended Learning Outcomes:  
After successful participation in this module students will be able to understand important basic terms, concepts and thinking of computer science, especially object-oriented programming, database & SQL, and basic algorithms and data structures. They are enabled to develop own programs. Students are able to apply database connections.

Teaching and Learning Methods:  
Lecture and practical exercises: In addition to a central exercise,
in which the concepts of the lecture were deepend on the basis
of examples, tutorials, in which simple tasks were solved on the computer under intensive support, impart
important practical
basic skills of programming, in order to apply the self-study acquired knowledge. In the second half of the
semester
students work on a practical project, that should deepen the
related understanding with regard to the desired learning
outcomes.

Media:
Slide presentation, blackboard, lecture and exercise recording, discussion forums in e-learning platforms; Working
on the PC

Reading List:
Heinz-Peter Gumm, Manfred Sommer, 2012, Einführung in die Informatik, Degruyter Oldenbourg
Marco Emrich, 2013, Datenbanken & SQL für Einsteiger, Create space independent publishing platform

Responsible for Module:
Dominik Grimm (dominik.grimm@hswt.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Introduction into Computer Science / Computer Application (Exercise / Campus Straubing) (exercise, 2 SWS)
Grimm D [L], Grimm D

Introduction into Computer Science / Computer Application (Lecture / Campus Straubing) (lecture, 2 SWS)
Grimm D [L], Grimm D

For further information in this module, please click
campus.tum.de or here.
Elective Modules Renewable Resources
Module Description

WZS0008: Physical Chemistry

TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The learning results are going to be proved in form of a written test. The students solve physical/chemical arithmetic problems and answer questions for definitions or physical/chemical relations. They prove that they have understand the basic relations of physical chemistry that are highlighted within the scope of the module and can use the systems of equations. Calculators are allowed additives. Other additives can be permitted by the lecturer as needed.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
A-level student knowledge of mathematics (especially differentiation and integration) and physics

Content:
Basics of chemical thermodynamics: laws of thermodynamics, forms of energy (U, H, G, S), relations of formulas; chemical equilibrium and chemical reactions; properties of gases; phase transition of pure substances and multiphase systems; two component systems; selected boundary surface phenomenons; basics of reaction kinetics.

Intended Learning Outcomes:
After successful completion of the module the students know the laws of thermodynamics; they are able to make calculations concerning U, H, S and G; they understand phase diagrams of one and two component systems, they can create charts and calculate the condition of equilibrium of simple systems; they can calculate with partial molar quantities in multi component systems; they can use ideal and real gas equations; they are able to form and solve equations related to the kinetics of chemical reactions and to determine the order of reactions.

Teaching and Learning Methods:
Teaching methods: In the lecture the teaching content is communicated by a talk of the lecturer, supported by PowerPoint and sketches on the blackboard in which the latter form is chosen to derivate complex relations. To a limited extent this can be completed for selected topics by self-study of the textbook by the students. In relation to the teaching content exercise sheets are disbursed on which the students work in self-study before the tutorials. The solution and discussion takes place in the tutorials. Learning methods: At the postprocessing of the lecture especially while the exercises are solved the students keep themselves intensive busy with the teaching contents of the lecture and reach in this way a understanding of the physical-chemical relations and practise the usage of the systems of equations.
Media:
PowerPoint, whiteboard, exercise sheets, textbook, optional: script

Reading List:

Responsible for Module:
Doris Schieder

Courses (Type of course, Weekly hours per semester), Instructor:
Physical Chemistry (Tutorial) (exercise, 2 SWS)
Burger J [L], Baumeister E, Schieder D

Physical Chemistry (Lecture) (lecture, 2 SWS)
Burger J [L], Burger J, Göttl Q, Schieder D

For further information in this module, please click campus.tum.de or here.
Module Description

WZS0015: Electrical Engineering

TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Exam achievement shall be done in the form of a written test (120 minutes). The students show that they are able to solve computational tasks relating to ac/dc circuits without tools. In addition the students show their understanding of the principles of energy conversion in electrical energy technology by answering questions on case studies.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Modules Physics and Mathematics

Content:
Introduction into electrical energy technology, basics of electrical engineering, especially:
- Charge, electric field
- Amperage, voltage, resistance
- Magnetic field, induction
- Power, electrical energy
- Circuits, Kirchhoff's laws
- Semiconductors
- Transformers, voltage levels
- Electromechanical energy conversion
simple application)s of electrical energy technology (Introduction into power plant technology

Intended Learning Outcomes:
After having participated in the module units the participants are aware of basics of electrical engineering and their associated physical laws. The students are able to use basic equations of electrical engineering to perform simple calculations relating to electrical engineering and energy technology. Furthermore the students are aware of different possibilities of energy conversion within the scope of electrical energy technology.

Teaching and Learning Methods:
The module consists of one lecture and an associated session of exercises. Contents of the lecture shall be imparted in a speech and deepened through independent preparation of exercises by the students. The finished exercises shall be discussed in the associated session of exercises.

Media:
Presentations, slide scripts, writing on the board
Reading List:
Klaus Heuck, Elektrische Energieversorgung, 2010, Vieweg Teubner;
Panos Konstantin, Praxisbuch Energiewirtschaft, 2009, Springer;
Horst Czichos (Hrsg.), Hütte - Das Ingenieurwissen, 2008, Springer;
Richard Zahoransky (Hrsg.), Energietechnik, 2013, Springer Vieweg

Responsible for Module:
Josef Kainz

Courses (Type of course, Weekly hours per semester), Instructor:
Electrical Engineering (Exercise) (exercise, 2 SWS)
Kainz J [L], Gaderer M, Härtl S, Kainz J, Koch K, Lugauer F

Electrical Engineering (Lecture) (lecture, 2 SWS)
Kainz J [L], Gaderer M, Kainz J, Koch K

For further information in this module, please click campus.tum.de or here.
Specialization in Technology: Medical Science

If students choose the specialization in technology Medical Science, they must successfully complete all modules listed.
Module Description

MEDWI001: Chemistry - Basic knowledge with clinical links

TUM School of Management

Module Level: Bachelor
Language: German
Duration: one semester
Frequency: summer semester

Credits:* 6
Total Hours: 180
Self-study Hours: 180
Contact Hours: 0

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Die Studienleistung besteht aus Übungsleistungen. Die Studierenden schließen das Modul erfolgreich ab, wenn sie 60% der gestellten Übungsaufgaben korrekt beantwortet haben. Mit Beantwortung der Übungsaufgaben zeigen die Studierenden, dass sie die chemischen Grundlagen der Anorganik und Organik erinnern und wiedergeben können. Darüber hinaus zeigen sie, dass sie die theoretischen chemisch-medizinischen Hintergründe der Praktikumsversuche erklären und anwenden können.

Repeat Examination: Next semester

(Recommended) Prerequisites:

Content:

Inhalte umfassen:
Anorganische Chemie
Organische Chemie
Stoffumwandlungen
Komplexe organische Moleküle

Intended Learning Outcomes:
Am Ende der Bearbeitung der Lernmodule sollen die Studierenden die chemischen Grundlagen der Anorganik und Organik wiedergeben können. Nach Bearbeitung der Praktikumsmodule sollen die Studierenden in der Lage sein, die theoretischen Hintergründe der Praktikumsversuche erklären und im Praktikum anwenden zu können. Die Studierenden können sollen das erworbene chemisch-medizinische Wissen in anderen vorklinischen und klinischen Fächern abrufen und anwenden können.

Teaching and Learning Methods:
VHB Online Kurs
Chat, Übungsaufgaben für Selbstlernbetrieb

Media:
Reading List:
Chemie für Mediziner - Zeeck, Axel (Herausgeber); Zeeck, Sabine Cécile (Beiträge); Grond, Stephanie (Beiträge)

Responsible for Module:
Dr. Kathrin Dethleffsen
k.dethleffsen@imul.de

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click
campus.tum.de or here.
## Module Description

**WZ8057: Biology Part 1**

### TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

### Description of Examination Method:
Die Lehrveranstaltung des Wintersemesters wird mit einer 1,5-stündigen Klausur abgeschlossen, in der die Studierenden nachweisen, dass sie
- die Grundbegriffe der Biologie beherrschen,
- die wichtigsten biologischen Prozesse erläutern können sowie
- wichtige biologische Herausforderungen analysieren und geeignete Lösungsmöglichkeiten aufzeigen können.

### Repeat Examination:
Next semester

### Recommended Prerequisites:
Grundkenntnisse der Naturwissenschaften

### Content:
Zellbiologie: Leben und Chemie; Zellen als kleinste Einheiten des Lebens; zelluläre Membranen
Genetik: Vererbung; Genomstruktur und Genexpression; vom Genotyp zum Phänotyp; Gentechnik; Anwendung künstlich veränderter DNA in der Biotechnologie
Mikrobiologie: prokaryotische Zelle; Bedeutung von Prokaryoten für die Stoffkreisläufe der Erde; medizinische und biotechnologische Bedeutung von Prokaryoten
Zoologie und Systematik: Grundlagen; System der Tierstämmle

### Intended Learning Outcomes:
Die Studierenden beherrschen und verstehen die zellbiologischen und genetischen Grundlagen der Biologie. Sie können den grundlegenden Aufbau von Zellen und die Mechanismen des genetischen Informationstransfers und der möglichen Einflussnahme erklären. Daneben verstehen sie die Grundlagen der zoologischen Systematik.

### Teaching and Learning Methods:
Das Modul setzt sich aus Vorlesungen zusammen, in denen die Inhalte von den Dozenten in Form von Präsentationen vermittelt und anhand von Beispielen vertieft werden.

### Media:
PowerPoint-Präsentationen
Reading List:

Responsible for Module:
Prof. Dr. Johannes Kollmann
jkollmann@wzw.tum.de

Courses (Type of course, Weekly hours per semester), Instructor:
Biologie Nebenfach Part 1 (lecture, 2 SWS)
Kollmann J [L], Kollmann J

For further information in this module, please click campus.tum.de or here.
Module Description

SG120020: Composition and Function of the Human Body

TUM School of Management

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<th>Language:</th>
<th>Duration:</th>
<th>Frequency:</th>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The written examination is held in a classroom (120 min). Within a limited time and without aids, it will be demonstrated that metabolic processes in the body based on the biochemistry are understood and that the metabolic pathways, their connectivity and their regulation, as well as the functions and structures of the human body can be reproduced. The answers require choosing from among given multiple choice options.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Human biological and biochemical knowledge of secondary level II is a prerequisite to understanding the contents.

Content:
Biochemical basis of metabolism:
- Liquid hormones
- Structures and functions of macronutrients
- Digestion and absorption
- Important nutrient-related metabolic pathways
- Krebs cycle and respiratory chain as a basis for further events in the field of medicine, health and nutrition.

Functional anatomy of the musculoskeletal system:
- Bones of the human body
- Ligaments of the human body
- Tendons of the human body
- Muscles of the human body
- Peripheral nervous system
- Functional aspects of the individual structures under different conditions such as age, sport and work world
- Health aspects

Intended Learning Outcomes:
After successfully completing the module, students will be able:
- to understand and describe the composition and the structures of the human musculoskeletal system
- to fundamentally understand the health effects of preventive and rehabilitative measures on the body
- to remember structures and functions of biomolecules and the mechanisms of biochemical reactions
- to understand and describe metabolic processes in the body on the basis of bio-chemistry
- to give an overview of the pathways of basal metabolism, its networking and its regulation
Teaching and Learning Methods:
The module consists of 2 lectures with blended learning components and an additional moodle-course. The content of the module is conveyed through lectures and presentations. Students will be encouraged to study the literature and the substantive discussion of the topics.

Media:
Presentation, Moodle

Reading List:

Responsible for Module:
Schulz, Thorsten; Dr. Sportwiss.

Courses (Type of course, Weekly hours per semester), Instructor:
Vertiefung biochemischer Schwerpunktthemen (Moodlekurs) (exercise, 1 SWS) Meinhold M, Schönfelder M
Biochemische Grundlagen des Stoffwechsels (lecture, 2 SWS) Schönfelder M
Festigung und Vertiefung funktioneller Strukturen des Bewegungsapparates (Moodlekurs) (exercise, 1 SWS) Schulz T
Functional anatomy of the musculoskeletal system (lecture, 2 SWS) Schulz T

For further information in this module, please click campus.tum.de or here.
Module Description
SG120025: Human Biology

TUM School of Management

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<td>90</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The written examination (120 min) is held in a classroom. In this, in a limited time and without aids, it will be demonstrated that the structures, functions and relationships of anatomy and physiology of the human body are understood. The answers require choosing from among given multiple choice options.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Composition and Function of the Human Body (esp. biochemistry)

Content:
- Structure/composition and function of the cell and tissue;
- Structure and function of the muscles and physiological functioning;
- Structure and function of the cardiovascular system (heart and blood vessels), the blood and immune system, the lymphatic system, the respiratory tract;
- Structure/composition and function of the endocrine system, the digestive system, the genitourinary system, the central nervous system.

Intended Learning Outcomes:
After successfully completing the module, students will be able:
- to understand the structure, development and function of the human body as well as individual specific organ systems, to describe them, and moreover apply biomedicine of the body to specific problems
- to understand preventive and rehabilitative influences on the body from the point of view of anatomy and physiology of the internal organs.

Teaching and Learning Methods:
The module consists of 2 lectures with blended learning components, a seminar and an exercise. The content of the module is conveyed through lectures and presentations. Students will be encouraged to study the literature and the substantive discussion of the topics. The exercise is offered via moodle. The seminar takes place as a field trip to the institute of pathology (LMU) where different tasks have to be passed.

Media:
Powerpoint, Moodle, Exhibits
**Reading List:**
Silverthorn DU: Physiologie. Pearson, München 2009
Faller A, Schünke M: Der Körper des Menschen. Thieme, Stuttgart 2012;
Platzer W: Taschenatlas der Anatomie. Thieme, Stuttgart 2011;
primary literature

**Responsible for Module:**
Oberhoffer-Fritz, Renate; Prof. Dr.med.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Anatomie und Physiologie der inneren Organe (exercise, 1 SWS)
Oberhoffer-Fritz R

Anatomie an der Leiche (seminar, 1 SWS)
Oberhoffer-Fritz R, Peters C, Schulz T, Weberruß H

Anatomie und Physiologie der inneren Organe (lecture, 4 SWS)
Oberhoffer-Fritz R, Schulz T

For further information in this module, please click
[campus.tum.de](http://campus.tum.de) or here.
Module Description

**MEDWI002: Medical terminology**

*Praktikum der medizinischen Terminologie*
TUM School of Management

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**Module Level:** Bachelor  
**Language:** German  
**Duration:** one semester  
**Frequency:** winter semester  

**Credits:** 3  
**Total Hours:** 90  
**Self-study Hours:** 90

Number of credits may vary according to degree program. Please see Transcript of Records.

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**Description of Examination Method:**

Die Prüfungsleistung besteht aus einer schriftlichen Multiple Choice Klausur (60 Minuten). In der Klausur weisen die Studierenden nach, dass sie die Grundlagen der medizinischen Terminologie verstehen. Sie zeigen, dass sie wichtige Fachbegriffe der medizinischen Terminologie korrekt wiedergeben und anwenden können.

**Repeat Examination:**  
Next semester

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**(Recommended) Prerequisites:**

Keine. Die Veranstaltung richtet sich insbesondere auch an Studierende ohne Vorkenntnisse in Latein und/oder griechisch oder medizinischer Terminologie

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**Content:**

Grundlagen der medizinischen Terminologie:

- Grundlagen der Lagebezeichnungen und Bezugssysteme der Anatomie  
- Ursprung der medizinischen Terminologie im Griechischen und Lateinischen  
- Grundlegender Aufbau und die Bildung medizinischer Fachbegriffe  
- Wichtige Prä- und Suffixe  
- Grundbegriffe der Organsysteme  
- Grundbegriffe der Krankheitslehre und deren Systematik  
- Grundbegriffe des ärztlichen Handelns  
- Besonderheiten und feststehende Begrifflichkeiten der Humanmedizin

---

**Intended Learning Outcomes:**

Nach der Teilnahme an den Modulveranstaltungen sind die Studierenden in der Lage  
(1) Grundlagen der medizinischen Terminologie zu verstehen  
(2) Wichtige Fachbegriffe der medizinischen Terminologie wiederzugeben und richtig anzuwenden

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**Teaching and Learning Methods:**


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**Media:**

Präsentation, Tafelarbeit, Übungen
Reading List:

Responsible for Module:
Hohendorf, Gerrit; Prof. Dr.med.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.
Module Description

MEDWI003: Medical Focus

*(Interdisziplinäre Vorlesung I und Epidemiologie)*

TU München School of Management

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**Module Level:** Bachelor  
**Language:** German  
**Duration:** one semester  
**Frequency:** winter semester  
**Credits:** 7  
**Total Hours:** 210  
**Self-study Hours:** 120  
**Contact Hours:** 90

Number of credits may vary according to degree program. Please see Transcript of Records.

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**Description of Examination Method:**

Die Prüfungsleistung wird in Form von zwei Klausuren (90 Minuten und 60 Minuten) erbracht.  
In der ersten Klausur (90 min) soll in begrenzter Zeit und ohne Hilfsmittel nachgewiesen werden, dass die behandelten Krankheitsbilder und pathophysiologischen Prozesse, erkannt und hinsichtlich grundlegender Eigenschaften, Diagnostik und Therapie bewertet werden können. Die Antworten erfordern das Ankreuzen von vorgegebenen Mehrfachantworten.  
In der zweiten Klausur (60 min) soll in begrenzter Zeit nachgewiesen werden, dass die behandelten statistischen und Epidemiologischen Verfahren erkannt und kontextbezogen korrekt angewendet und berechnet werden können. Ein Taschenrechner ist als Hilfsmittel zugelassen.  

Da alle Modulveranstaltungen gemeinsam mit den Studierenden der Medizin besucht werden, ist es aus organisatorischen Gründen leider nicht möglich eine gemeinsame Modulprüfung anzubieten.  
Beide Klausuren werden miteinander zu einer gemeinsamen Modulnote verrechnet.

**Repeat Examination:**

End of Semester

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**(Recommended) Prerequisites:**

Kenntnisse der Anatomie, Physiologie, Biochemie und medizinischen Terminologie werden vorausgesetzt, dies beinhaltet die Module:

- Naturwissenschaftliche Grundlagen  
- Biochemie und funktionelle Anatomie  
- Anatomie und Physiologie der inneren Organe  
- Medizinische Terminologie

Darüber hinaus empfehlen sich Kenntnisse der deskriptiven Statistik und des Aufbaus, Designs und der Auswertung wissenschaftlicher Studien.

---

**Content:**

Das Modul Medizinische Vertiefung bildet ein Kernelement des Schwerpunktes Medizin für Studierende des Bachelor Management & Technology. Die einzelnen Modulveranstaltungen bieten einen umfassenden Querschnitt der gesamten medizinischen Breite ab. Die Ergänzung der Modulveranstaltung Interdisziplinäre Vorlesung, die grundlegende Krankheitsbilder und deren Entstehung aufzeigt, um die Modulveranstaltung Epidemiologie, welche die verschiedenen Krankheitsbilder in die Praxis und Forschung überträgt, zeigt ein umfassendes Bild der medizinischen Anwendungsgebiete auf.  
Konkrete Inhalte der Modulveranstaltungen sind:
Grundlegende Krankheitsbilder, pathophysiologische Entstehungsprozesse, therapeutische und diagnostische Optionen aus den Bereichen:
- Neurologie (motorische vs. sensorische, zentrale vs. periphere Störungen)
- Blut (Gerinnung)
- Neoplasien (Tumorzellbiologie und Leukämien)
- Säure-Basen und Elektrolythaushalt und deren Entgleisungen
- Stoffwechselstörungen (Gicht, Zuckerstoffwechselstörungen)
- Leberfunktionsstörungen
- Endokrinologie
- Verdauungsstörungen am Beispiel der Diarrhö
- Herzensuffizienz und Herzklappenfehler
- Knöcherner- und Bewegungsapparat
- Gasaustausch
und weitere

Grundlagen der Epidemiologie und deren Anwendung im medizinischen Kontext:
- Feststellen und Berechnen von statistischen Kennzahlen
- Erkennen und Erforschen von Krankheitsursachen und deren Risikofaktoren
- Untersuchung des Verlaufs von Krankheiten und Identifikation von prognostischen Kriterien
- Arten und Kriterien von und für Studien und deren Aussagekraft
- Maßzahlen zur Beschreibung von Krankheitsbildern
- Genetik und Epidemiologie
- Standardisierung und Odds-Ratio

**Intended Learning Outcomes:**
Nach der Teilnahme an den Modulveranstaltungen sind die Studierenden in der Lage
(1) Grundlegende pathophysiologische Konzepte zu erfassen
(2) Die Bedeutung ausgewählter Krankheitsbilder und deren Therapie zu verstehen
(3) Ausgewählte Krankheits- und Therapiemodelle nachzuvollziehen und wiederzugeben
(4) Angemessene Fachtermine anzuwenden und verstehen
(5) Aufgaben der Epidemiologie im medizinischen Kontext zu verstehen
(6) Maßzahlen zur Beschreibung von Krankheitsbildern auszuwählen, zu verstehen und zu berechnen
(7) Prognostische und statistische Kriterien im Kontext von wissenschaftlichen Studien anzuwenden

**Teaching and Learning Methods:**
Das Modul besteht zum einen aus Vorlesungen und Fragestunden zur Vorlesung.
Der zweite Teil des Moduls besteht aus einer Vorlesung und einer zugehörigen Zentralübung.
In den Vorlesungen werden die Inhalte präsentiert und diskutiert. In der Zentralübung werden vor allem gemeinsam Fallbeispiele erarbeitet und verschiedene Fragestellungen diskutiert, während in den Fragestunden vor allem gemeinsam spezifische Fragen erarbeitet oder beantwortet werden.
Alle Modulveranstaltungen werden zusammen mit den Studierenden der Medizin besucht. Zu dem Konzept der Interdisziplinarität zählt auch die Vernetzung der Studierenden der verschiedenen Fachrichtungen untereinander. Da die Studierenden der Medizin die deutlich größere Kohorte bilden, ist es aus organisatorischen Gründen leider nicht möglich eine gemeinsame Modulprüfung zu anzubieten.

**Media:**
Präsentation. TED-Befragungen, Tafelarbeit, Übungen

**Reading List:**

**Responsible for Module:**
Renders, Lutz; Apl. Prof. Dr. med.
Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.
Module Description

MEDWI004: Medical Science and Practice

(Berufsfelderkundung + Praktikum + Notfallmedizin Praktikum)
TUM School of Management

**Module Level:** Bachelor  
**Language:** German  
**Credits:** 4

**Duration:** two semesters  
**Frequency:** winter/summer semester

**Total Hours:** 120  
**Self-study Hours:** 60  
**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

**Description of Examination Method:**
Die Prüfungsleistung besteht aus dem Verfassen eines Berichtes.
In dem Bericht zeigen die Studierenden, dass sie die wesentlichen Aspekte der Organisation und des Betriebs einer ärztlichen Einrichtung erfassen und beschreiben können. Darüber demonstrieren die Studierenden ihre Fähigkeit, die Schnittstellen zwischen Betriebswirtschaft und ärztlichem Handeln zu identifizieren und einzuordnen.

**Repeat Examination:**  
Next semester

**(Recommended) Prerequisites:**
Kenntnisse der Anatomie, Physiologie, Biochemie und medizinischen Terminologie werden vorausgesetzt, dies beinhaltet die Module:

- Naturwissenschaftliche Grundlagen  
- Biochemie und funktionelle Anatomie  
- Anatomie und Physiologie der inneren Organe  
- Medizinische Terminologie

Empfohlen werden Kenntnisse der Pathophysiologie und Krankheitslehre, dies beinhaltet die Module:

- Interdisziplinäre Vorlesung 1

**Content:**
Das Modul zeigt den Studierenden medizinische Fachgebiete auf verschiedenen Ebenen.

Die Studierenden erhalten einen Einblick in die verschiedenen Fachdisziplinen der Humanmedizin und deren Anforderungen, Aufgabengebiete und Besonderheiten in Form von Kurzvorträgen.

Das Praktikum absolvieren die Studierenden im Bereich einer ambulanten oder stationären Einrichtung der Krankenversorgung um:
- Sich mit der ärztlichen Patientenversorgung vertraut zu machen  
- Besonderheiten des medizinischen Betriebs kennenzulernen  
- Praktische Einblicke in ärztliches Handeln und die diesem zugrunde liegenden Entscheidungen zu erhalten.

Im Rahmen des notfallmedizinischen Praktikums werden die Studierenden gängige notfallmedizinische Verfahren (Reanimation und Defibrillation, Atemwegssicherung und IV-Zugang) kennenlernen und üben.
Intended Learning Outcomes:
Nach der Teilnahme an den Modulveranstaltungen sind die Studierenden in der Lage
(1) Die verschiedenen Fachdisziplinen, deren Aufgabenfelder und Besonderheiten zu benennen
(2) Die Organisation und den Betrieb einer ärztlicher Einrichtungen beispielhaft zu beschreiben
(3) Krankheitsbilder und deren praktische Therapie beispielhaft zu beschreiben
(4) Die Schnittstellen zwischen Betriebswirtschaft und ärztlichem Handeln zu erkennen und zu beschreiben

Teaching and Learning Methods:

Media:
Präsentationen, praktische Arbeiten, Anleitungen, Übungen

Reading List:

Responsible for Module:
Berberat, Pascal; Univ.-Prof. Dr.med.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.
Module Description

IN8005: Introduction into Computer Science (for non Informatics studies)

TUM School of Management

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<th>Language:</th>
<th>Duration:</th>
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Credits:* Total Hours: Self-study Hours: Contact Hours:
5 150 90 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Type of Assessment: written exam (90 minutes)
The exam takes the form of written test. Knowledge questions allow to assess acquaintance with and understanding of the basic concepts of Computer Science. Small programming and modelling problems allow to assess the ability to practically apply the learned programming- and query-languages and modelling-techniques for the solution of small problems.
Homework will be scored and upon achieving a minimum equired number of points, a 0.3 bonus for the final grade is granted.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Recommended requirements are Mathematics modules of the first year of the TUM-BWL bachelor's program as well as the module WI000275 'Management Science'.

Content:
The module IN8005 is concerned with topics such as:
- Database Management Systems, ER models, Relational Algebra, SQL
- Java as a programming language:
  ++ basic constructs of imperative programming (if, while, for, arrays etc.)
  ++ object-oriented programming (inheritance, interfaces, polymorphism etc.)
  ++ basics of Exception Handling and Generics
  ++ code conventions
  ++ Java class library
- Basics of Visual Basic for Applications
- Basic algorithms and data structures:
  ++ algorithm concept, complexity
  ++ data structures for sequences (arrays, doubly linked lists, stacks & queues)
  ++ recursion
  ++ hashing (chaining, probing)
  ++ searching (binary search, balanced search trees)
  ++ sorting (Insertion-Sort, Selection-Sort, Merge-Sort)

Intended Learning Outcomes:
Upon successful completion of the module, participants understand important foundations, concepts and ways of thinking of Computer Science, in particular object-oriented programming, databases and SQL, and basic algorithms and data structures, have an overview over these topics and be able use them for the development of
own programs with a link to a database in a basic way.

**Teaching and Learning Methods:**
Lecture and practical tutorial assignments. A central tutorial deepens the understanding of the concepts introduced in the lecture using example assignments in regard to being able to solve given problems. In the tutorials, the students solve basic assignments under intensive supervision, which contributes to providing them with the basic skills in programming, in order to be able to apply the knowledge acquired by self-study of the accompanying materials of lecture and central tutorial for autonomously solving the programming assignments of the homework. During the second half of the semester, the students work on a small practical project, which aims at deepening the connected understanding of the desired learning outcomes. Programming aspects of this project are distributed over tutorial and homework assignments and are aligned with the topics of the respective week.

**Media:**
Slides, blackboard, lecture- and central tutorial recording, discussion boards in suitable e-learning platforms

**Reading List:**
Chapters from textbooks, which are closely associated with the module content and are provided to the students online.

**Responsible for Module:**
Seidl, Helmut; Prof. Dr.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Introduction into Computer Science (for non Informatics studies, TUM BWL) (IN8005) (lecture, 2 SWS)
Groh G

Exercise Session for Introduction into Computer Science (for non Informatics studies, TUM BWL) (IN8005) (exercise, 2 SWS)
Groh G [L], Dall'Olio G, Groh G, Steinberger C

For further information in this module, please click campus.tum.de or here.
Project Studies
Module Description

WI000684: Project Studies

TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The project study is a practical project, where a studentical team of 2-5 students work on a specific task of a company or any other similar institution (including research projects at university chairs). Here the students frame the state of research and describe their own specific solution. Based on scientific knowledge and methodical skills, the students evolve the task. The project study is supported by a professor of the TUM School of Management and a company. The students frame the state of research and develop their own specific approach for a solution based on scientific knowledge as well as methodical skills. Depending on the project, the student team presents the results of the project study through a written term paper. Grading will especially take into account the overall working outcome of the project with respect to the initial problem set, the selection and application of the chosen methodology as well as the discussion of the main findings. The project is set up in a way which enables identification and evaluation of each student's individual contribution to the project's success.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge in Business Administration

Content:
In the project study, students acquire hands-on experience by working in student teams with companies/institutions on a particular assignment.
Examples are
- the application of optimization tools for problems out of the logistic sector,
- the application of specific use cases for new electronic payment procedures,
- the capturing and processing of KPIs in controlling,
- or the description of a marketing strategy.
They structure the project and employ their methods and theories to develop results of practical value for the company/institution. The project is supervised jointly by mentors from the respective partner company and the professor of the TUM School of Management. With regards to content the project study takes an approximate time of three to six month.

Intended Learning Outcomes:
After successful participation in the module students are able work on a project in a systematic and academic manner. They can contribute an own part to a team's work output. They can make this contribution in a time limited environment. The students can identify and express problem sets. Furthermore they can name appropriate methodologies for problem solving and they can transfer them to the solution. Finally they can choose and apply the appropriate methodologies to solve the problem.
**Teaching and Learning Methods:**
The creation of the project solution in a team encourages the students to deal soundly with a practical subject. They are able to communicate the evolution of the project within the team and to present the solution to the supervisors from the company/institution and the university.

**Media:**
literature, presentations

**Reading List:**
General literature to project management:

**Responsible for Module:**
Ernstberger, Jürgen; Prof. Dr. rer. pol. habil.

**Courses (Type of course, Weekly hours per semester), Instructor:**

For further information in this module, please click campus.tum.de or here.
Electives in Management and/or Technology

For the Elective in Management & Technology, students must pass examinations in the area of management or technology worth 18 credits. The following is a sample catalog of electives.
Chemistry
Module Description

CH0575: General and Inorganic Chemistry  [CH0575]

TUM School of Management

Module Level: Bachelor
Language: German
Duration: one semester
Frequency: summer semester
Credits:* 6
Total Hours: 180
Self-study Hours: 120
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Voraussetzung ist Interesse an Chemie als experimentelle Naturwissenschaft.

Content:
Aufbau der Materie; Chemie, Stoffe, Stofftrennung; Atombau und Periodensystem der Elemente; Moleküle, chemische Verbindungen; Chemische Bindung; Chemische Reaktionen; Chemische Gleichgewichte; Säuren und Basen; Festkörperchemie, Festkörperstrukturen; Elektrochemie; Grundlegende Stoffkenntnisse zu Hauptgruppenelementen; wichtige technische Verfahren.

Intended Learning Outcomes:

Teaching and Learning Methods:
Das Modul besteht aus einer Vorlesung (4 SWS), in welcher die Inhalte im Vortrag und durch Präsentationen vermittelt werden. Die Studierenden sollen zum Studium der Literatur und der inhaltlichen Auseinandersetzung mit den Themen angeregt werden. Die Präsentationen werden über einen download- Bereich zur Verfügung gestellt. Mit Übungsaufgaben, die durch Tafelanschrieb präsentiert und gelöst werden, werden konkrete Fragestellungen

**Media:**
PowerPoint-Präsentationen, Tafelschrieb, Frontalübungen, Videos, Versuchsvorführung, Übungsböcker, Moodle

**Reading List:**
- Riedel/Janiak Anorganische Chemie 9. Auflage 2015 (de Gruyter);

**Responsible for Module:**
Köhler, Klaus; Prof. Dr.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Experimental Inorganic Chemistry (lecture, 4 SWS)
Köhler K

For further information in this module, please click campus.tum.de or here.
Computer Engineering
Module Description

EI10001: Principles of Information Engineering  [PIE]

TUM School of Management

**Module Level:** Bachelor  
**Language:** English  
**Credits:** 6  
**Duration:** one semester  
**Frequency:** summer semester  
**Total Hours:** 180  
**Self-study Hours:** 135  
**Contact Hours:** 45

Number of credits may vary according to degree program. Please see Transcript of Records.

**Description of Examination Method:**
The module examination is based on a written exam (75 minutes) which contains questions to assess the students' knowledge about the technical systems, e.g. information transmission systems, and their theoretical background, e.g. design principles, short mathematical problems to assess the students' mastering of the practiced mathematical concepts, and conceptual questions (e.g., about design principles or fundamental limitations) to assess the further intended learning outcomes. Up to 20% of the examination can be conducted in the form of multiple choice questions.

**Repeat Examination:**
End of Semester

**(Recommended) Prerequisites:**
The following module should be successfully completed prior to participation: MA9711 Mathematics in Natural and Economic Science 1.
The following module is recommended to be attended in parallel (if not already attended earlier): MA9712 Statistics for BWL.

**Content:**
* Fundamentals:
  - Elements of Stochastic Modeling and Analysis
  - Signals (analog/digital, deterministic/stochastic, real/complex)
  - The Frequency Domain (Fourier transform, spectrum and bandwidth, sampling theorem)
  - Information Theory (fundamentals, source coding, channel coding, channel capacity)
* Information Transmission and Storage Systems:
  - Elements of Data Transmission (transmission chain, filtering, modulation, detection)
  - Communication Systems (real systems compared to theory, channel models, performance criteria, comparison to data storage, current trends)
  - Communication Networks (network structures, interference, broadcast and multiple access, multihop and relaying, abstraction layers, network planning)
* Elements of Information Processing
  - Data Processing Devices (abstraction layers, real systems compared to theory, digital processing, algorithms and complexity)
  - Data Acquisition and Analysis (sampling and quantization, information and noise modeling, feature extraction, machine learning)
  - Security Aspects (reliability, security, secrecy, encryption)
Intended Learning Outcomes:
After attending the module, the students:
- can describe the main principles of operation of information transmission systems and networks as well as of data processing devices and methods
- are familiar with fundamental design principles of such systems and understand why existing systems are designed the way they are
- have an overview of the underlying physical and mathematical principles and can distinguish fundamental limitations from technological constraints
- have learned to take an engineering perspective on information transmission and processing tasks (e.g., by structuring a system into building blocks and abstraction layers)
- know the main mathematical methods relevant for this field of engineering and are able to apply a selection of these methods to example problems

Teaching and Learning Methods:
The module is designed for non-engineering students (in particular students in Management and Technology) who aim at understanding the fundamental principles and concepts of modern information transmission and processing. It consists of lectures, tutorials, and self-study.

In the lectures, both theoretical backgrounds and technical implementations are introduced and discussed. Mathematical concepts are introduced and explained as far as it is necessary for understanding the technical systems. The relevance of each of the considered topics is motivated by, e.g., press articles, teaser questions, or examples from daily life, and an additional reflexion at the end of each topic unit aims at conveying the engineering perspective on the considered problems and systems. New concepts are presented in a teacher-centered style and discussed in an interactive manner.

The aim of the tutorials is to repeatedly practice the application of the mathematical concepts as well as the ability to answer conceptual questions about the subject. The tutorials are held in a student-centered way, and problem sheets are provided.

Throughout the semester, short reading assignments may be given to the students, e.g., as an introduction to a new topic. In addition, the students are expected to recapitulate the lecture contents and to individually practice the exercises.

Media:
- Slide Presentations
- Blackboard (e.g., for mathematical details)
- Supporting documents (e.g., news articles, scientific publications) as downloads (reading assignments)
- Problem sheets as downloads

Reading List:
Recommendations and downloads are provided during the course separately for each topic.

Responsible for Module:
Utschick, Wolfgang; Prof. Dr.-Ing.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.
Innovation and Entrepreneurship
Module Description

WI000026: Advanced Technology and Innovation Management

TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The grade results from a two-hour closed book exam. During the exam students demonstrate that they understand theoretical concepts and core literature within innovation management. They show that they can analyze and evaluate innovation processes. In addition, students may participate in voluntary group presentations to improve their overall grade by 0.2/0.3. With the additional presentation (10 minutes) students show that they are able to apply theoretical concepts to real-life examples.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Technology and Innovation Management: Introduction or similar introductory lecture on innovation management

Content:
Advanced Technology and Innovation Management addresses aspects and topics concerning the organisation of the innovation process, such as organizing and managing innovation, open and distributed innovation, and innovation strategy. The module consists of five blocks with the topics: (1) Innovation and Markets, (2) Open Innovation, (3) Organizing for Innovation, (4) Managing Innovation, (5) Profiting from Innovation and Innovation Strategy. The individual lectures cover topics such as: Determinants of Innovation, Crowdsourcing, Corporate Venture Capital, Innovation Culture, and IP Protection.

Intended Learning Outcomes:
At the end of the module students will be able to analyze the innovation process within the firm. Students will be able to decide where R&D cooperation is necessary and how corporate culture and incentive systems can motivate employees to be innovative. Students have reached an in-depth understanding of core theoretical concepts and are able to apply these concepts to real-life examples.

Teaching and Learning Methods:
The module consists of a lecture. Presentation by lecturer, case study discussions between students and lecturer, student presentations with discussion. During the module students work in-depth with the relevant literature and core theoretical concepts. Students have the possibility to apply the concepts discussed in class during the in-class case study discussion and in their voluntary presentation.

Media:
PowerPoint, film excerpts
Reading List:
More relevant literature is made available for students during the course of the module.

Responsible for Module:
Henkel, Joachim; Prof. Dr. rer. pol.

Courses (Type of course, Weekly hours per semester), Instructor:
Advanced Technology and Innovation Management (WI000026) (lecture, 4 SWS)
Henkel J

For further information in this module, please click
campus.tum.de or here.
Module Description

WI000285: Innovative Entrepreneurs - Leadership of High-Tech Organizations

Gründung und Führung von wachstumsorientierten Unternehmen

TUM School of Management

Module Level: Bachelor/Master
Language: German
Duration: one semester
Frequency: winter/summer semester

Credits: 3
Total Hours: 90
Self-study Hours: 60
Contact Hours: 30

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The examination consists of a multiple-choice exam (60 minutes), through which it is assessed how well the participants have grasped basic economic terms, the effectuation principle in entrepreneurship, Design Thinking as a mindset and process, as well as other concepts covered by the guest speakers at the lectures.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
- Knowledge: No special requirements, willingness to participate
- Abilities: Identifying opportunities; proactiveness; communication; commitment
- Skills: openness; analytical thinking; visual thinking; self-motivation; networking

Content:
The objective of the module is to inspire and motivate the participants coming from various disciplines for an entrepreneurial career, and to give them a basic understanding about founding and managing technology- and growth-oriented companies. To serve this purpose, the module provides an introduction to the topic of (effectual) entrepreneurship, as well as guest lectures by outstanding founders, entrepreneurs, managers, and investors on selected topics, such as:

1. The entrepreneurial ecosystem
2. Founding of companies for students and scientists
3. How to develop an idea into a market-ready product
4. Financing of startups
5. Corporate growth
6. Creating and managing an entrepreneurial culture
7. Strategic business management
8. Innovation management
9. Corporate finance
10. Business succession

Moreover, for self-motivated participants, there is ample opportunity for personal development through interactive workshops, closed networking events, and an online platform to support communications with the guest lecturers.

Intended Learning Outcomes:
Upon successful completion of this module, participants will be able to:
- understand effectual entrepreneurship;
- understand basic economic terms, such as Intellectual Property, Cashflow, Venture Capital, Controlling;
- understand Design Thinking methodology;

Moreover through guest speakers' lectures and optional workshops participants will be empowered to:
- realize opportunities and challenges associated with the founding and managing of technology- and growth-oriented companies;
- create a personal roadmap for entrepreneurial success.

Thus, students familiarize with topics like opportunity recognition, innovation management, growth, leadership, and the facets of entrepreneurship. In doing that, they are enabled to see, realize, and experience the multiplicity in the everyday life of an entrepreneur, entrepreneurial personalities, as well as entrepreneurial skills and motivations.

**Teaching and Learning Methods:**
The module consists of a weekly lecture series in combination with a 3-hour workshop.

As guest lecturers, each week an outstanding founder, entrepreneur, manager, or investor, spanning a wide-ranging industrial spectrum, is hosted to report on their individual entrepreneurial careers.

At the end of each lecture, the participants can actively engage in discussions with the guest speaker during an open session. For participants to put their networking skills to test, each guest speaker is also hosted at a restaurant for dinner following the lecture, together with 3-5 motivated participants. All participants can apply for the dinner through the online platform of the module.

Moreover, in context of a 3-hour workshop, the participants venture their own personal qualities and skills to understand in a structured way their own entrepreneurial identity. In doing that, they focus on their individual strengths and resources to develop a plan to be entrepreneurial.

The module also provides participants with ample opportunity to network with people from the entrepreneurial environment of TUM.

**Media:**
- Lecture slides downloadable from www.unternehmertum.de
- Online discussion forum (e.g., for questions and feedback on guest lectures)
- Hand-outs (distributed online)

**Reading List:**

**Responsible for Module:**
Schönenberger, Helmut; Dr. rer. pol.
Courses (Type of course, Weekly hours per semester), Instructor:
Innovative Entrepreneurs (lecture, 2 SWS)
Schönenberger H [L], Schönenberger H

For further information in this module, please click campus.tum.de or here.
Module Description

WI001143: Intellectual Property Management in the Global Market Place

TUM School of Management

Module Level: Bachelor
Language: English
Duration: one semester
Frequency: winter semester

Credits:* 3
Total Hours: 90
Self-study Hours: 60
Contact Hours: 30

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
In the final assessment students will need to demonstrate to what extent they have met the Learning Objectives. This assessment will be held as a written exam of 60 minutes. Students will be asked theoretical questions. This will demonstrate to what extent they have memorised and understood principles of Intellectual Property Management in the Global Market Place. Students will also be asked to apply their knowledge of patent procurement, licensing and enforcement strategies in the global market to known and fictional cases. This second part demonstrates if students have developed the required legal analytical skills. Students also need to demonstrate their ability to apply their knowledge to fact settings not discussed in the lecture, and to evaluate the legal consequences.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
none

Content:
This module provides an introduction to basic concepts of patent procurement, licensing and enforcement strategies in the global market.
Topics covered are:
- Data included in patent documents and information available from the data
- The global market for intellectual property
- Cutting edge technology fields such as 3D printing, regenerative medicine, etc.
- Patent procurement strategies
- Licensing strategies
- Patent enforcement strategies
- Development and execution of R&D and business strategies

Intended Learning Outcomes:
At the end of this subject students will be able
(1.) to understand the basic principles of patent procurement, licensing and enforcement strategies in the global market,
(2.) to grasp the legal framework of business activity,
(3.) to analyse economic and legal implications of typical business situations and to identify their options,
(4.) to present the results of their analysis in a written memorandum.
Teaching and Learning Methods:
The lecture will cover the theoretical aspects of the module in a discussion with the lecturer. It will also provide the opportunity to work individually or in groups on case scenarios (known and unknown), covering issues of patent procurement, licensing and enforcement strategies in the global market. The purpose is to repeat and to intensify the content discussed in the lecture and to review and evaluate legal issues from different areas of law in everyday situations. Students will develop the ability to present these findings in a concise and well-structured written analysis.

Media:
Presentations (PPT)

Reading List:

Responsible for Module:
Ann, Christoph; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
VO, Intellectual Property Management in the Global Market Place, 2 SWS
Toshiko Takenaka

For further information in this module, please click campus.tum.de or here.
Marketing, Strategy and Leadership
## Module Description

**WI000996: High Performance Leadership [HPL]**

*Wie Sie Ihre Mitarbeiter und auch sich selbst zu Bestleistungen führen*

TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

### Description of Examination Method:

The grading is based on a written exam. The exam takes 90 minutes and consist of a series of open-ended and closed-ended (i.e. multiple choice) questions. The questions refer to antecedents, processes and effects of efficient talent- and change management in organizations as well as the feautures of goalsetting and current leadership research. The main aim of multiple choice questions is to test the theoretical knowledge of the students. The open-ended questions, on the other hand, require students to describe theoretical concepts and approaches with their own words and to apply them to concrete, practice-oriented problems and challenges.

### Repeat Examination:

End of Semester

### (Recommended) Prerequisites:

None

### Content:

The participants learn how they, as future leaders, can lead themselves, their followers, and teams to their highest level of sustained performance. The focus of the lecture is on the following aspects:

- The role of leadership in Talent Management (here, the focus is on identifying and developing talents)
- Efficient goal setting (here, the focus is on motivating and guiding followers toward goals)
- The role of leadership in change management (the focus is on leadership tools that have proven successful during organizational change)

### Intended Learning Outcomes:

Upon successful completion of this module, students will be able to:

- name basic principles of efficient talent management and understand the importance of leadership in this matter
- outline the basic principles of goalsetting and explain methods and tools of successful goal achievement
- discuss the basic principles about change management and understand the role of leaders in this process
- Regarding the above aspects: students can describe the strengths and weaknesses of existing approaches and theories in the field. Furthermore, they will be able to connect different theories and describe their value for concrete challenges in practice. This enables students to develop concrete approaches to solving practical problems.
Teaching and Learning Methods:
The module is a lecture, which includes interactive elements. Lectures are a format suitable to convey theoretical knowledge. On the one hand, the instructor provides the participants with theoretical input. On the other hand, students engage in classroom discussion and group work on specific topics.

Media:
Exercise sheets, Flipchart, PowerPoint

Reading List:
Alexander Groth: Führungsstark in alle Richtungen (extracts)
Alexander Groth: Führungsstark im Wandel (extracts)

Responsible for Module:
Peus, Claudia; Prof. Dr. phil.

Courses (Type of course, Weekly hours per semester), Instructor:
High Performance Leadership (WI000996) (lecture, 2 SWS)
Steinberg U [L], Groth A

For further information in this module, please click campus.tum.de or here.
Module Description

WI001028: Basic Principles and international Aspects of Corporate Management

TUM School of Management

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<td>180</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Grading is based on a written exam (120 min.), a non-programmable pocket calculator is allowed. Questions of the exam which are similar to the discussed case studies allow students to demonstrate their ability to analyze and evaluate basic aspects of corporate management. Moreover tasks on arithmetics and theory are used to check whether students can deduct and quantify different aspects of employees’ motivation and adapt them on issues related to entrepreneurial business. An examination retake is offered at the end of the following term. Given a very low number of participants the exam can be replaced by an oral exam with requirements on the same level.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
none

Content:
The module gives an overview on the below mentioned aspects of corporate management:
- basic principles of corporate management
- theories of corporate management: new institutional economics
- system of corporate management: leadership levels, leadership process
- normative corporate management: company values, targets, culture, and mission, code of conduct
- strategic corporate management: value-oriented management, strategies
- corporate planning and control
- human resource management
- corporate management and motivation
- theory of globalization
- globalization strategies
- characteristics of family-owned companies

Intended Learning Outcomes:
After attending the module students are able to analyze and evaluate basic principles of corporate management. They can deduct recommendations and develop company-specific decisions in management. Furthermore students know how to assess pros and cons regarding the applicability and impacts on corporate management. Students learn to estimate the challenges of companies regarding the motivation of their employees and how these challenges can be structured and evaluated to develop tailored solutions. After successful participation students are able to assess specifications of family-owned firms compared to public companies and evaluate potential measures of the company-specific management. Students can also evaluate aspects of international corporate management and design appropriate strategies regarding globalization.
**Teaching and Learning Methods:**
The module consists of a lecture and an additional tutorial. Knowledge transfer is guaranteed by lecture and presentation as well as by small case studies and arithmetic examples. Students are encouraged to study literature and analyze the issues of the topics. The tutorial provides a deeper knowledge of the theoretical concepts presented during the lecture, on the other hand reference examples and case studies are carried out. Furthermore potential applications are demonstrated how to implement theoretical concepts in practice on the background of empirical scientific studies. Additionally students learn how to apply the acquired knowledge e.g. by using case studies.

**Media:**
Presentations, charts, exercises, case examples

**Reading List:**

**Responsible for Module:**
Mohnen, Alwine; Prof. Dr.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Basic Principles and international Aspects of Corporate Management (WI001028) (lecture with integrated exercises, 4 SWS)
Mohnen A, Pabst S

For further information in this module, please click campus.tum.de or here.
Module Description

WI001192: Evidence Based Decisions Using Big Data Analytics  [EEBDA]

TUM School of Management

**Module Level:** Bachelor  
**Language:** German  
**Duration:** one semester  
**Frequency:** winter/summer semester

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Number of credits may vary according to degree program. Please see Transcript of Records.

**Description of Examination Method:**
Students have to take a written exam of 60 minutes (multiple choice). In the exam students show that, first, they understand the methods used in Big Data Analytics and, second, are able to apply those methods in small case studies. Moreover, students show that they are able to identify challenges and trends in Big Data Analytics. There is an exam next semester. There are no aids allowed for the exam.

**Repeat Examination:**  
Next semester

**Recommended Prerequisites:**  
Basics in business & economics, mathematics and statistics

**Content:**
The module gives an introduction in Big Data Analytics as well as its application possibilities. The module focuses on accompanying case studies providing amongst others basic knowledge in data processing. The case studies contain the following elements:
1. Economic theory/questions (including practitioner interviews)
2. Data preparation and exploratory data analysis
3. Purposeful data processing (model estimation and analysis)
4. Interpretation of the results with regard to 1. (but also dangers of the analyses, e.g. spurious correlations or ethical aspects associated with the analyzes, etc.)

Regarding bullet point 4, additional online services are provided and students are encouraged to discuss ethical issues online. At the end of this module an outlook is given regarding the current priorities in Big Data Analytics.

**Intended Learning Outcomes:**
Upon successful completion of this module, students are able
- to distinguish characteristics of Big Data Analytics in regard to traditional business theory/decisions/methods (in particular in regard to data creation, data storage, data processing).
- to identify (operational) opportunities for Big Data Analytics in business and management.
- to apply basic methods of data collection, processing, and evaluation.
- to recognize challenges in Big Data Analytics (e.g. data privacy, data security, ethical considerations, etc.).
- to identify and apply trends and developments in Big Data Analytics for their later career.

**Teaching and Learning Methods:**
The module consists of an introductory lecture using a virtual webinar, extensive tutorials, educational videos, and interviews. The modul is supplemented by exercises supervised by teaching assistants. This modul is a self-study modul including exercises and webinars which enables students to independently access and practice the learning
materials.

**Media:**
Educational Tutorials (lecture notes), interview videos, educational videos, literature

**Reading List:**
1. "Big Data Fundamentals, Concepts, Drivers & Technologies" by Thomas Erl et al.
2. "Mastering Machine Learning with R" by Cory Lesmeister
3. "Understanding Machine Learning, from theory to algorithms" by S. Shalev-Shwartz and S. Ben-David

**Responsible for Module:**
Ernstberger, Jürgen; Prof. Dr. rer. pol. habil.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Evidence Based Decisions Using Big Data Analytics (lecture, 4 SWS)
Ernstberger J [L], Ernstberger J, Fischer D

For further information in this module, please click
[ campus.tum.de](http://campus.tum.de) or [ here](http://).
Operations and Supply Chain Management
Module Description

WIB19807: Topics in Operations & Supply Chain Management I [TPLS-I]

TUM School of Management

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<td>Bachelor</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The assessment takes place in form of a written exam (120 min) at the end of the semester. In the exam students demonstrate that they are able to explain, discuss and critically evaluate specific concepts of operations and supply chain management. Furthermore, they proof that they can apply the discussed quantitative approaches for operations and supply chain management, assess these approaches in terms of effectiveness and efficiency.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
The module "Management Science" und "Production and Logistics" is a prerequisite.

Content:
In this module, we address current topics in operations and supply chain management on an undergraduate level. The topics vary but always focus either on a specific function within operations and supply chain management or operations and supply chain management for specific industries, for example: planning and scheduling in the automotive industry. Within the specific focus the fundamental concepts and the current main challenges are discussed. Quantitative approaches used in that context are discussed, applied and evaluated.

Intended Learning Outcomes:
At the end of the module the students will be able
- to explain operations and supply chain management concepts related to a specific topic
- to discuss the current industry challenges for a certain topic and their influence on planning problems and function within operations and supply chain management
- to apply quantitative approaches introduced in the course to topic specific (planning) problems
- to assess these approaches in terms of effectiveness and efficiency

Teaching and Learning Methods:
The module consists of lectures with integrated exercises.
In the lectures the contents of the module are delivered through presentations and talks. In the integrated exercises students apply their knowledge to solve case assignments. The results are then discussed in class. The students improve the acquired knowledge by studying the suggested literature.

Media:
Presentation slides
Technical papers

Generated on 11.03.2020
Case studies

Reading List:

Responsible for Module:
Grunow, Martin; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Topics Operations & Supply Chain Management I (WIB19807): (Sales and Operations Planning in the Automotive Industry) (lecture, 4 SWS)
Grunow M [L], Schömig-Beißner M, Stäblein T

For further information in this module, please click campus.tum.de or here.
Module Description

WI000264: Project Management [PM]

TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Students’ mastery of the learning outcomes of this module is assessed with a 60 minutes written exam, during which students are only allowed to use a non-programmable calculator and a one-page handwritten sheet.

In the exam students have to demonstrate their ability to solve small project planning and management problems and to interpret planning results. They do this by answering questions and applying the mathematical concepts taught in the module. Answering the exam questions requires the knowledge, understanding and application of the module content.

Three optional group assignments (with 3-4 students per group) will be throughout the course. Successfully undertaking these assignments, students will obtain a bonus of 0.3 grades on their exam grade.

Repeat Examination:
Next semester

(Recommended) Prerequisites:

Content:
Projects are unique endeavors and in our dynamically changing world, many undertakings have a project character. In order to manage projects successfully, specific skills and tools are necessary. The module Project Management teaches the basic quantitative tools for managing projects successfully.

The following basic project management techniques are covered in this module:

- Work breakdown structure (WBS);
- Activity-on-node network (AON);
- Metra potential method (MPM);
- Critical path method (CPM);
- Activity-on-arc networks (AOA);
- Planning material, resources and costs;
- Maximizing the project’s net present value;
- Resource-constrained project scheduling;
- Stochastic project scheduling with PERT;
- Monte Carlo Simulation;
- Planning and simulating projects with the Project Team Builder (PTB);
- Controlling projects with milestone trend analysis (MTA) and earned value analysis (EVA);
- Financial project evaluation with decision tree analysis (DTA).
Multi-criteria project evaluation with the Analytic Hierarchical Process (AHP),
- Multi-criteria project planning with goal programming,
- Project portfolio planning,
- New planning approaches (Agile Project Management, Critical Chain),
- Industry standards (PRINCE, PMBOK).

Intended Learning Outcomes:
Students will learn the basic tools required to plan and manage projects using quantitative approaches for example MPM, CPM, EVA and DTA. Also, students will obtain insights into the "mechanics" of projects, i.e. how the parts of a project, the goals of a project and the project planning phases are interlinked. They will become familiar with decision analysis tools, which can be used beyond project management. The students will be empowered to successfully evaluate, select, plan and control projects.

Teaching and Learning Methods:
The module consists of lectures and exercise courses. In the lectures the content is delivered through presentations, discussion, cases, games and industry talks. For the exercises students prepare homework and discuss the solutions with the teaching assistant. The exercise will help students learning the course content by applying what they have learned in the lectures. Furthermore, the exercise will prepare students for the written examination at the end of the course.

Media:
Presentation Slides, Spreadsheet examples

Reading List:
Shtub, Bard and Globerson: Project Management, Pearson Prentice Hall (latest Version), papers which will be provided through the Moodle e-learning platform.

Responsible for Module:
Kolisch, Rainer; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Project Management Exercise (WI000264) (exercise, 2 SWS)
Godbersen G, Kolisch R

Project Management (WI000264) (lecture, 2 SWS)
Kolisch R

For further information in this module, please click campus.tum.de or here.
Module Description

WI000978: Transportation Logistics

TUM School of Management

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<th>Module Level:</th>
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<td>Bachelor</td>
<td>English</td>
<td>one semester</td>
<td>winter semester</td>
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Credits:*  
6  

Total Hours: 180  
Self-study Hours: 120  
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The grading is based on a written exam (90 minutes) consisting of 4 questions, the participants can choose 3 out of 4. Each question has several parts assessing the different competence levels. In a first theory part, the student has to reproduce knowledge about transportation logistics concepts. In a second part, different calculation methods need to be applied with given data and the results be analyzed and interpreted. In a third part, the students need to develop ideas and concepts beyond the reproduction of knowledge and application of methods. In order to facilitate calculations and for backup of some formulas, a formula sheet and a pocket calculator can be used.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Produktion und Logistik, Management Science

Content:
The module will give an overview on different problems in freight and public transportation and present the basic concepts and algorithms for the solution of various problems.

Besides different variants of the classical transportation problem, the content covers:
- the travelling salesman problem,
- vehicle routing problems with several extensions,
- train routing problems,
- packaging problems,
- fleet sizing, and
- transportation network design.

Intended Learning Outcomes:
Students will be able to give an overview on characteristics of different transportation modes. They will be able to model transportation, routing and network design problems as mixed-integer linear program and to solve these problems with heuristics to provide practical decision support and to understand the concepts and methods behind commercial decision support software.

Teaching and Learning Methods:
The module includes lectures where students obtain knowledge about transportation modeling and optimization techniques. In exercise sessions, the students solve problems with the obtained knowledge, perform optimizations, interpret the findings and present and discuss their results to the others participants in the classroom. Guest
lectures given by industry professionals supplement the theory parts and give the participants the opportunity to recognize problems, discover interesting challenges for choosing their thesis work and discuss with practitioners.

Media:
Literature, Slides

Reading List:

Responsible for Module:
Minner, Stefan; Prof. Dr. rer. pol.

Courses (Type of course, Weekly hours per semester), Instructor:
Transportation Logistics (WI000978) (lecture with integrated exercises, 4 SWS)
Albinski S, Malicki S, Minner S

For further information in this module, please click campus.tum.de or here.
Finance and Accounting
Module Description

WI000091: Corporate Finance

TUM School of Management

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<th>Module Level:</th>
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Credits:*

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<td>120</td>
<td>60</td>
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</table>

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

At the end of the course, there will be a written, closed book, multiple choice, final exam which will take 120 minutes. This exam consists of theoretical questions regarding corporate finance (e.g. characteristics of real options, when to apply which company valuation method, theoretical considerations on the optimal capital structure) as well as performing applied computations (e.g. valuing real options, computing equity values by discounting cash flows, adjusting firm risk measures for leverage). The theoretical questions are mainly based on the lecture whereas the calculations are mainly based on the tutorial.

Furthermore, students have the option to write a one-hour, closed book, multiple choice midterm exam. With this exam students can improve their final grade by one fraction (0.2/0.3). The exam covers the material from the first half of the term, students show that they are able to explain and evaluate the most common concepts in corporate finance. By completing calculations students demonstrate that they are able to apply these concepts.

Repeat Examination:

Next semester

(Recommended) Prerequisites:

The student should have a solid understanding of finance fundamentals (discounting cash flows, risk, CAPM). These topics are covered in the course "Investitions- und Finanzmanagement" or in other introductory finance classes.

Content:

The module covers fundamental concepts in corporate finance. This knowledge is important as a fundament for advanced courses in corporate finance as well as a career in the investment banking or in a corporate treasury department.

- Options: Basic understanding, put call parity, binomial and Black-Scholes option pricing, equity as call option
- Real options: Identification and binomial pricing
- Valuation: Introduction to DCF methods, multiples methods and applications
- IPO: Empirical studies of IPO costs, IPO process
- Capital structure: WACC under OPM, CAPM and MM, trade off theory of debt, agency theory of debt, pecking order theory of debt
- Efficient markets: Definitions, modeling, empirical approaches and results
- M&A: Explanations of wealth effects of M&A, explanations for conglomerates, Empirical results on other forms of ownership decreases and change (divestitures, carve outs, spin offs, tracking stock, split ups, LBOs)
- Dividend policy: Theories of optimal dividend policy, Empirical evidence
Intended Learning Outcomes:
After successful completion of the module, students will be able to explain the most common concepts in corporate finance such as real and financial options, company valuation, market efficiency and dividend and leverage policies. Furthermore, they are able to discuss critically these topics. Finally, they will be able to apply the above concepts and decide on corporate financial policies as well as evaluate financial and real options and companies (e.g., by using option theory or DCF methods).

Teaching and Learning Methods:
There is a weekly lecture and tutorial. During the lecture, the content is presented with the help of slides and computations on a tablet computer. Students can gain a deeper understanding by solving the weekly problem sets. The solution to these problem sets is presented each week during the tutorial.

Media:
Presentation slides and white board.

Reading List:
Required:

Further recommended readings will be given in the lecture.

Responsible for Module:
Kaserer, Christoph; Prof. Dr. rer. pol. habil.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.
Module Description

WI001083: Controlling

TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The examination consists of a 60-minute written exam. The only aid permitted is a non-programmable calculator. Students answer theoretical questions about concepts, tasks and instruments of controlling and management accounting. Furthermore, they apply instruments to solve exemplary problems of management accounting, discuss the adequacy of instruments to solve these problems and interpret their results. By answering these questions, students show how far they are able to (1) remember and understand the basic concepts, tasks and conception of controlings systems, (2) analyze problems concerning coordination of planning and control in management systems and (3) apply adequate instruments of controlling to solve these problems.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
none

Content:
The module introduces students to the basics and instruments of controlling and management accounting. It covers topics such as planning & control, personnel management and coordination, organization in management systems, budgeting and target development, performance indicators, and transfer-pricing-systems.

Intended Learning Outcomes:
The intended learning outcomes of this module are: (1) students will be able to remember and understand the basic concepts, tasks and conception of controlling systems and coordination systems (e.g. coordination-oriented controlling conception, instruments of coordination, relationship between planning and controlling); (2) they will be able to analyze problems concerning the coordination of planning and control in management systems; (3) they will be able to apply the newly acquired knowledge to solve these problems.

Teaching and Learning Methods:
The module consists of a lecture and a tutorial. During the lectures the contents are delivered by presentations and discussions. The students are inspired to improve the acquired knowledge by studying the suggested literature. In the tutorials the students apply the acquired knowledge in solving exercises and implementing case studies. There will also be a guest speaker who will show the students the application of various controlling tools in practice.

Media:
presentations, text books, lecture notes, exercises, lecturio
**Reading List:**


**Responsible for Module:**
Friedl, Gunther; Prof. Dr.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Controlling (WI001083) (lecture, 2 SWS)
Friedl G [L], Friedl G, Gamarra Y

Controlling - Exercise (WI001083) (exercise, 2 SWS)
Friedl G [L], Gamarra Y

For further information in this module, please click campus.tum.de or here.
Module Description

WI001108: Law of Business Association 2

TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
In the final assessment students will need to demonstrate to what extent they have met the Learning Objectives. This assessment will be held as a written exam of 60 minutes. The exam consists of two parts which count for approximately 50 per cent each.
In the first part, students will be asked theoretical questions. This will demonstrate to what extent they have memorised and understood principles of the law of companies, in particular regarding formation, liability, governance and capital raising.
Students will also be asked to apply their knowledge to known and fictional cases. This second part demonstrates if students have developed the required legal analytical skills. Students also need to demonstrate their ability to apply their knowledge to fact settings not discussed in the lecture, and to evaluate the legal consequences.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Students are expected to have a general understanding of basic principles of civil law (for example by prior attendance of the module "Introduction to German Business Law I" or equivalent).

Content:
This module covers the law of business associations which is available larger enterprises.
It includes units on introduction to company law in general, and in particular the law of the stock corporation (AG) and the Societas Europaea (SE), but also regarding the private limited company (GmbH). In the course of the subject the requirements for setting up the company, the economic background and relevance of the legal structure, management, organs, liability, capital requirements, dissolution and the particular specifics of the structure will be addressed. The module also covers issues of European company law, the law of corporate groups, and the link between company and securities law (IPO).

Intended Learning Outcomes:
At the end of this module students will be able
(1.) to understand and specify the available legal forms under German Law for their business and to choose the most appropriate legal form for the business;
(2.) to grasp und apply company law issues in practice, in particular regarding formation and capital raising, management, principles of governance liability;
(3.) to analyse legal implications of typical business situations involving companies and to identify their options;
(4.) to present the results of their analysis in a written analysis.
Teaching and Learning Methods:
The lecture consists of two basic elements. Each topic will be presented by the lecturer. The presentations are followed by case studies of the concerning topic. This provides the opportunity to work individually or in groups on case scenarios. The purpose is to repeat and to intensify the content discussed in the lecture. Moreover, the students structured work is strengthened and thus, the writing skills for the exam are improved.

Media:
Presentations, reader, case studies and model answers

Reading List:
Langenbucher, Kapitalmarktrecht (3. Aufl., 2015)

Responsible for Module:
Maume, Philipp; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Law of Business Association 2 (WI001108) (lecture, 2 SWS)
Maume P

For further information in this module, please click campus.tum.de or here.
Informatics
Module Description

IN0001: Introduction to Informatics 1

TUM School of Management

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<td>120</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Type of Assessment: exam (120 minutes)

The exam takes the form of 120 minutes written test. Questions allow to assess acquaintance with concepts of Informatics and programming, small programming tasks assess the ability to conceive appropriate algorithmic solutions and realize concurrent applications.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Participants should attend IN0002 "Fundamentals of Programming (Exercises & Laboratory)" at the same time.

Content:
The module IN0001 is concerned with topics such as:
- Introduction
  ++ Basic notions: Problem - algorithm - program
  ++ Imperative programming constructs
- Syntax and semantics
  ++ Syntax of programming languages: regular expressions and context-free grammars
  ++ Semantics of programs: control-flow graphs
- Basic data structures I
  ++ Numbers, strings, arrays
  ++ Insertion sort
- Recursion
  ++ Binary search
  ++ Patterns of recursion
- Basic data structures II
  ++ Objects, classes, methods
  ++ Lists, stacks, queues
- Object-oriented programming
  ++ Inheritance
  ++ Abstract classes and interfaces
  ++ Polymorphism
- Programming in the large (perspectives)
- Concurrency and Threads
Intended Learning Outcomes:
Upon successful completion of the module participants understand the essential concepts of computer science on a fundamental, practice-oriented, but scientific level. Concepts of this kind are for example: Algorithms, syntax and semantics, as well as efficiency in terms of memory consumption or time. Participants are then able to solve well-posed algorithmic problems and to implement basic distributed and concurrent applications in Java or a similar object-oriented language. They understand the underlying concepts and models and are therefore able to acquire skills in other imperative and object-oriented programming languages on their own.

Teaching and Learning Methods:
lecture, combined with experimental assessment of examples at the computer and evaluation of further readings

Media:
slide show, blackboard, online programming experiments, animations, lecture recording

Reading List:
Heinisch, Müller-Hofmann, Goll: Java als erste Programmiersprache, Teubner, 2007
Deitel, Harvey / Deitel, Paul: How to program Java Prentice-Hall, 2002
Flanagan, David: Java in a Nutshell O'Reilly, 2002
Bishop, Judith: Java gently Prentice-Hall, 2001
Eckel, Bruce: Thinking in Java Prentice-Hall, 2002

Responsible for Module:
Seidl, Helmut; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Introduction to Informatics 1 (IN0001) (lecture, 4 SWS)
Seidl H, Erhard J, Hagerer G, Kynast E

For further information in this module, please click campus.tum.de or here.
Electrical Engineering and Information Technology
Module Description

EI0644: Photovoltaic Stand Alone Systems  [PVI]

TUM School of Management

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<tbody>
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<td>Bachelor</td>
<td>German</td>
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<td>summer semester</td>
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Credits:*  
Total Hours:  
Self-study Hours:  
Contact Hours:  

5  
150  
90  
60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Im Rahmen einer 60 minütigen schriftlichen Klausur wird durch Beantworten von Wissensfragen und Modellrechnungen zur Auslegung von Anlagen überprüft, inwieweit Studierende die Eigenschaften und Einsatzbereiche von Inselsystemen wiedergeben können.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Keine speziellen Anforderungen

Content:
Die Vorlesung vermittelt die Grundlagen sowie Methoden zur Auslegung photovoltaischer Inselsysteme.
- Einführung
- Grundlagen Solarstrahlung
- Aufbau und Funktionsweise einer Solarzelle
- Elektrotechnische Ersatzschaltbilder
- Solarmodule / Solarsysteme/ Ersatzschaltbilder
- Energieertrag (Abhängigkeiten)
- Speicherproblematischen Speichertecnologien
- Speicherlösungen und deren Grenzen in photovoltaischen Anwendungen
- Betriebsstrategien
- Klassische Auslegung von photovoltaischen Inselsysteme
- Modellbasierte Auslegung
- Wirtschaftlichkeitsaspekte
- Hybridsysteme

Intended Learning Outcomes:
Die Teilnehmer verfügen nach erfolgreichem Abschluss des Moduls über grundlegende Kenntnisse photovoltaischer Inselsysteme und können die Auslegung dieser Systeme vornehmen, beispielsweise Solar Home Systeme, Dorfstromversorgungen und photovoltaische Kleingeräte.

Teaching and Learning Methods:
Als Lehrmethode wird in der Vorlesung Frontalunterricht, ergänzt durch Gruppendiskussionen, verwendet. Ferner sollen Exponate zur Veranschaulichung eingesetzt werden und einige Zusammenhänge werde auch mittels Animationen gezeigt.

**Media:**
Folgende Medienformen finden Verwendung:
- Präsentationen mit Laptop und Beamer
- Tafelanschrieb
- Diskussionen zu Fachaufsätzen und aktuellen Themen, wie Speicher in der Elektromobilität und Speicher für die Enmergewende.

**Reading List:**
Allgemeine Literatur wird in der Vorlesung bekannt gegeben.
Es werden verschiedene Zeitschriftenbeiträge online zur Verfügung gestellt, die dann auch in der Vorlesung diskutiert werden.

**Responsible for Module:**
Jossen, Andreas; Prof. Dr.-Ing.

**Courses (Type of course, Weekly hours per semester), Instructor:**

For further information in this module, please click campus.tum.de or here.
Module Description

El10002: Principles of Electrotechnology [PiET]

TUM School of Management

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<td>180</td>
<td>120</td>
<td>60</td>
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*Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
This module will be assessed in a written final examination (90 min) after the teaching weeks. In this examination it is to verify that the candidates are able to understand the general principles of electrical engineering and to solve relevant problems in the fields covered in this module in a limited time and without any resources. The examination will cover all parts of the lectures and exercises.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Knowledge of electricity and magnetism on high school level.
Basic knowledge of vector analysis.

Content:
Electrostatics:
Electrical charges, Coulomb's law, electrostatic fields, electrostatic potentials and voltages.

Dielectric materials:
Polarisation, dielectric displacement vector, Gauß' law, capacitors and capacitances.

Stationary electrical currents:
Current densities, local and integral Ohm's law, Kirchhoff's laws, resistors and resistivities, electrical networks, voltage and current sources, equivalent circuits, electrical energy and power.

(Electro-)magnetism:
Fundamental terms in magnetism, magnetic dipoles, Dia-, Para-, Ferromagnetism, magnetising field, magnetic induction, Amperé's law, electromagnetic induction, Faraday's law, inductors and inductivities, transformers.

Intended Learning Outcomes:
After participating in the modules lectures and exercises, students are able to understand and apply the basic physical principles of electrical engineering. They have acquired basic knowledge and understanding of some of the underlying problem-solving methods of electrical engineering.

Teaching and Learning Methods:
Teaching methods in lectures and exercises: Lecture-style instructions mainly on the blackboard.
In solving relevant exercises a deeper knowledge of the subject-matters presented in the lectures is sought.
Media:
The following media types are used in the lectures and exercises:
- Explanations and exemplifications on the black board, partly supplemented by computer-aided presentations.
- Downloads on the Internet.
- Exercises are provided with the objective that the students first should solve the problems independent by themselves, solution to the problems will be demonstrated in subsequent exercise sessions, and subsequently will be made available also via download on the Internet.

Reading List:
References will be presented in the first lecture hour.

Responsible for Module:
Schrag, Gabriele; Prof. Dr. rer. nat. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Principles in Electrotechnology (lecture, 3 SWS)
Wittmann F

Principles in Electrotechnology (exercise, 1 SWS)
Wittmann F [L], Hölzl W ( Eßing S )

For further information in this module, please click campus.tum.de or here.
Module Description

EI10003: Analog Electronics  [AE]

TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
This module will be assessed in a written final examination (90 min) after the teaching weeks. In this examination it is to verify that the candidates are able to understand the general principles of analog electronic circuits and to solve simple but relevant problems in the fields covered in this module in a limited time and without any resources. The examination will cover all parts of the lectures and exercises of this module.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Subject matters as presented in the module "Principle of Electrotechnology"
Calculus; complex numbers and operations for ac signal analysis

Content:
Electronic signals
Circuit analysis (dc, ac)
Electrical characteristics of electronic devices
Electronic filters
Basics of semiconductor¿s physics
PN Junctions, pn diodes
Transistors
Basic Transistor circuits
Amplifiers

Intended Learning Outcomes:
After participating in the modules lectures and excercises, students are able to
- understand and apply the basic principles of analog electronic circuits
- have acquired basic knowledge and understanding of some of the basic problem-solving methods of electronic circuits.

Teaching and Learning Methods:
Teaching methods in the lectures and excercises: frontal teaching with presentations and on the blackboard.
In solving relevant exercises a deeper knowledge of the subject matters of the lessons is sought.

Media:
The following media types are used in the lectures and excercises:
- Presentations (also for downloads on the Internet)
- Explanations and exemplifications on the black board
- Exercises are provided with the objective that the students first should solve the problems independent by themselves, the solutions to the problems will be demonstrated in subsequent excercise sessions, and subsequently will be made available also via download on the Internet.

**Reading List:**

**Responsible for Module:**
Schrag, Gabriele; Prof. Dr. rer. nat. habil.

**Courses (Type of course, Weekly hours per semester), Instructor:**

For further information in this module, please click campus.tum.de or here.
Mechanical Engineering
Module Description

MW1694: Machine Elements - Basics, Manufacturing, Application  [ME-BMA]

TUM School of Management

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<td>Bachelor</td>
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<td>one semester</td>
<td>winter semester</td>
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Credits: 7

Total Hours: 210

Self-study Hours: 135

Contact Hours: 75

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Grundlagen der Produktion, Maschinenzeichnen und elastostatische Mechanik

Content:

Intended Learning Outcomes:
Nach der Teilnahme an den Modulveranstaltungen sind die Studierenden in der Lage grundlegende Zusammenhänge von Maschinenelementen zu verstehen und zu bewerten. Sie können:
- Normen anwenden, Toleranzen und Passungen entwickeln sowie Oberflächengüten bewerten
- Statische Festigkeitsnachweise anwenden
- Stoffschlüssige Verbindungen, wie z.B. Schweißen, Löten, Kleben und Nieten) bewerten.
- Schraub- und Welle-Nabe-Verbindungen entwickeln
- Gestaltungsrichtlinien in der Konstruktion anwenden
- Paarungen und Lager analysieren
- Getriebe verstehen
- Schmierungen und Dichtungen erinnern
Teaching and Learning Methods:
In der Übung werden Beispielaufgaben gemeinsam mit den Studierenden berechnet, besprochen und diskutiert. Damit soll erreicht werden, dass die Studierenden sich selbstständig die Lernergebnisse aneignen sowie Transferleistungen erbringen können.

Media:
Präsentation, Filme

Reading List:

Responsible for Module:
Zäh, Michael; Prof. Dr.-Ing.

Courses (Type of course, Weekly hours per semester), Instructor:
Machine Elements and Manufacturing (lecture, 2 SWS)

Machine Elements and Manufacturing (exercise, 3 SWS)
Zhao X, Zäh M, Busch M, Ellinger J, Meyer S, Sigl M

For further information in this module, please click campus.tum.de or here.
Module Description

MW1108: Engineering Mechanics for Technology Management [TM TUM BWL]

TUM School of Management

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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
In a 120-minute written examination, the understanding of the imparted principles and techniques of engineering mechanics is tested by application of them on various problems. These calculation problems are similar in the style to the exercises, where the students are intended to analyse, to systematically tackle and to solve the tasks included.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Good knowledge in applied mathematics. Recommended courses: "Mathematische Behandlung der Natur- und Wirtschaftswissenschaften 1+2" or "Höhere Mathematik"

Content:
Basic principles of statics, elastostatics and kinetics: force, moment (torque), equilibrium, method of sections, center of mass, energy and stability, stress and strain, elastic constitutive law, Mohr's circle, (Euler-Bernoulli) beam theory, area moments of inertia, kinematics and kinetics of particles, impact, vibrations.

Intended Learning Outcomes:
After successful participation the students are able to
- apply terminology, principles and techniques of engineering mechanics
- analyse, tackle and solve new problems out of the covered fields
- create self-dependently particular knowledge in the field of engineering mechanics on the basis of the conveyed fundamentals
- understand subsequent lectures at the faculty of mechanical engineering
- create a level of communication with engineers in their daily professional life.

Teaching and Learning Methods:
The module consists of a lecture including exercises as well as a tutorial in small groups on a weekly basis. The lecture includes several teaching methods such as presentations, animations, short films and the usage of a blackboard. The current subject matter is repeated in tutorials and further examples are exercised. All teaching and exercise material as well as proposals for solutions and further information can be downloaded from the E-Learning platform.

Media:
Presentations, blackboard.
Documents via E-Learning platform.

**Reading List:**
Gross - Hauger - Schnell: Technische Mechanik 1, Springer Verlag
Gross - Hauger - Schröder - Wall: Technische Mechanik 2, Springer Verlag
Hauger - Schnell - Gross: Technische Mechanik 3, Springer Verlag
Wriggers - Nackenhorst - Beuermann - Spiess - Löhner: Technische Mechanik kompakt, Springer-Vieweg-Verlag

**Responsible for Module:**
Werner, Ewald; Prof. Dr.

**Courses (Type of course, Weekly hours per semester), Instructor:**
Engineering Mechanics for Technology Management - Exercises (exercise, 1 SWS)
Werner E [L], Krempaszky C (Jahn Y)

Engineering Mechanics for Technology Management (lecture, 2 SWS)
Werner E [L], Krempaszky C (Jahn Y)

Engineering Mechanics for Technology Management - Group Exercises (exercise, 2 SWS)
Werner E [L], Krempaszky C (Jahn Y)

For further information in this module, please click [campus.tum.de](http://campus.tum.de) or [here](#).
Renewable Resources
Module Description
WZS0005: Forestry and Wood

TUM School of Management

Module Level: Bachelor
Language: German
Credits:* 6

Duration: one semester
Frequency: winter semester
Total Hours: 180
Self-study Hours: 120
Contact Hours: 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Exam achievement shall be done in the form of a written test (exam duration: 90 minutes). Product pathways of timber harvest shall be reflected here. Classification of economic and ecological aspects of forestry from cultivation to harvesting shall be explained by using examples of particular cases. Recognition of wood and wood materials shall be shown. The relation of knowledge of the forest with regard to knowledge of different woods and wood utilisation will be evaluated at a ratio of 1 to 1. The answers require own formulations from the respective technical jargon of the timber industry.
Type of exam: In writing

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge in silviculture: Different thinning concepts. Location differences with their effects on selection of tree species.

Content:
The module aims at providing in-depth knowledge to the students in the field of timber harvest, from working methods to forest basics. Special emphasis is given to the interfaces concerning wood use (sawing, wood materials and paper industry) of energy wood production. The differences of farming systems of plantation, commercial forest, near-natural forest and the effect on biodiversity shall be shown. In a further aspect differences of woods shall be addressed from a microscopic point of view through to their field of application in the manufacturing industry. Silviculture as a result of climate change with new forms of cultivation such as short-rotation plantations and their combinations such as hedges, hedgerow substitution in the sense of agro-forestry models shall be presented. This also includes knowledge of by-products such as roadside planting as a raw material.

Intended Learning Outcomes:
After attending the module the student shall be able to characterise the product pathways in forestry especially for timber harvest. He will be able to represent forestry-related working methods. He distinguishes different forms of economy and is able to classify them according to economic, social and ecological aspects. He recognises differences of woods, knows various new products produced from wood and understands their production paths. He is able to mention by-products and their applications and use. He understands the main features of agro-forestry systems.

Teaching and Learning Methods:
The course attendance of forestry and wood consists of one lecture. For this purpose a powerpoint presentation shall be used. A study trip to a wood processing plant including lectures from qualified personnel providing
information from experience on site with common rounds of questions provides in-depth knowledge of the production paths. A so-called block determination, i.e. the determination of wood by means of different genuine wood samples, will be performed by a magnifying glass 10x.

**Media:**
Script, powerpoint, objects of wood and derived timber products. Study trip to a company with guided tour of processing and treatment of wood. Determination of wood with a magnifying glass 10x.

**Reading List:**
Sprache: Deutsch
ISBN-10: 3800155702
Holger Sohns, 2012: Moderne Holzernte. Ulmer Verlag
Michael Paulitsch und Marius C Barbu, 2015: Holzwerkstoffe der Moderne. DRW Verlag

**Responsible for Module:**
Cordt Zollfrank (cordt.zollfrank@tum.de)

**Courses (Type of course, Weekly hours per semester), Instructor:**
Forestry and Wood/Wood based Resources (Lecture) (lecture, 2 SWS)
Zollfrank C [L], Röder H, Zollfrank C

Forestry and Wood/Wood based Resources (Tutorial) (exercise, 2 SWS)
Zollfrank C [L], Röder H, Zollfrank C

For further information in this module, please click [campus.tum.de](http://campus.tum.de) or here.
Module Description
WZS0014: Basics Plant Growing

TUM School of Management

**Module Level:** Bachelor
**Language:** German
**Duration:** one semester
**Frequency:** winter semester

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<thead>
<tr>
<th>Credits:*</th>
<th>Total Hours:</th>
<th>Self-study Hours:</th>
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<tbody>
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Number of credits may vary according to degree program. Please see Transcript of Records.

**Description of Examination Method:**
The exam of the module shall be done in the course of an exam in which the students are to describe different basics of plant growing. By means of questions and tasks comprehension of contexts and interactions between different spheres of action of cultivation systems (e.g. location and production processes) shall be tested. The students explain active principles and objectives of alternative cultivation methods and interpret them for practical application. Type of exam: In writing, Exam duration: 90 minutes

**Repeat Examination:**
Next semester

**(Recommended) Prerequisites:**
none

**Content:**
The module aims at imparting to students basic knowledge of cultivation of plant biomass for the use of renewable resources. For that purpose agricultural location as a decisive production factor, integration of cultivation of the respective crops into a cultivation system (farm, types of farms to crop rotations) to the individual process steps of plant production (sowing, fertilisation, crop protection etc.) shall be treated.

**Intended Learning Outcomes:**
After having participated in the module units the students are able to describe basics of agronomy and plant production.
- The students are able to classify different production prerequisites (location, types of farms etc.) as basics for the cultivation of renewable resources,
- The students are able to mention basic production measures and processes of plant production (soil tillage, fertilisation etc.),
- They have understood the significance and functions of different production measures, are able to describe why the measures are required and which impacts shall be pursued and
- the students are able to distinguish alternative methods and procedures within production measures and discuss their pros and cons (e.g. conventional vs. preservative soil tillage).

**Teaching and Learning Methods:**
The module shall be essentially performed in the teaching format of a lecture. For selected thematic blocks the latter shall be completed by individual and group projects within the scope of which the students are able to independently treat and present well outlined contents. In order to improve learning success repetitions shall be integral part of the module. These are performed by the students in form of short presentations.
For the treated thematic blocks questions of repetition shall be provided in Moodle by means of which the students are able to verify their knowledge independently.

**Media:**
Lecture, presentations (individual and group projects)

**Reading List:**
Diepenbrock 2014: Nachwachsende Rohstoffe (Renewable Resources). UTB Ulmer (Stuttgart)
Baumer, : Allgemeiner Pflanzenbau (General Plant Production) UTB Uni-Taschenbücher (Stuttgart).

**Responsible for Module:**
Norman Siebrecht (norman.siebrecht@tum.de)

**Courses (Type of course, Weekly hours per semester), Instructor:**
Basics in Agronomy (lecture, 4 SWS)
Siebrecht N [L], Siebrecht N

For further information in this module, please click campus.tum.de or here.
Module Description

WI001183: Energy & Climate Policy

TUM School of Management

<table>
<thead>
<tr>
<th>Module Level:</th>
<th>Language:</th>
<th>Duration:</th>
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<td>180</td>
<td>120</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The course entails a final written exam (120 minutes). Topics covered in the exam relate to all learning outcomes of the module. Grading depends fully on the written exam so as to individually test the ability to apply economic concepts to new problem settings in energy markets. The exam will be a closed-book exam, because the core of the exam is to apply knowledge to new problems which students should be fully familiar with by the end of the module. By taking a midterm assignment, which consists of working on case studies and presenting the results in class, students can improve their final grade by 0.3. This part of the grading captures the ability of the students to apply the learned concepts to loosely structured cases.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Courses at TUM or elsewhere in microeconomics

Content:
Achieving the aims of this module requires knowledge on the subject per se but likewise the ability to apply economic and technical concepts. To this end this module comprises content on:

- Scientific basis of climate change
- New technologies for emissions abatement and their deployment in liberalized energy markets
- Economics of energy markets
- Energy policy
- Microeconomics
- Fundamentals of primary energy markets
- Fundamentals of electricity markets

Intended Learning Outcomes:
Students acquire knowledge on technical, political, and economical aspects of climate change and the associated challenges. They gain understanding on different technology options and regulatory strategies to mitigate climate change. Students are able to discuss and apply theoretical methods to selected topics in economics and business. With these tools student will thus be able to analyze and assess recent energy market developments, such as for instance the energy transition.

Teaching and Learning Methods:
The lectures present different topics so as to familiarize students with all economics and business issues relevant to climate change. A guest lecture is planned in which practitioners present on selected topics in energy markets.
The case-studies comprise different topics that discuss problems covered during the lecture. Case studies are solved in group work and supported by a presentation.

Media:
Slides, case-studies, reader

Reading List:

Responsible for Module:
Schwenen, Sebastian; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Energy & Climate Policy (lecture 2 SWS) Sebastian Schwenen
Energy & Climate Policy (lecture 2 SWS) David Wozabal

For further information in this module, please click campus.tum.de or here.
International Experience & Communication Skills
Module Description

WI001197: International Experience

TUM School of Management

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<th>Module Level:</th>
<th>Language:</th>
<th>Duration:</th>
<th>Frequency:</th>
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<tbody>
<tr>
<td>Bachelor</td>
<td>English</td>
<td>one semester</td>
<td>winter/summer semester</td>
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<table>
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<tr>
<td>3</td>
<td>90</td>
<td>90</td>
<td>0</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Students have to pass a written single-choice exam. The module examination consists of a written 60-minute single-choice exam. The tasks examine basic knowledge of the meaning of culture, cultural differences and resulting difficulties. Tasks which refer to scientific cultural concepts verify that students are able to describe different cultural dimensions and standards, for example the cultural dimensions of Geert Hofstede's concept. Tasks which refer to country-specific cultural differences examine that students are able to interpret critical intercultural situations correctly and show how to behave adequately. Tasks which refer to intercultural communication examine that students are able to identify different communication styles influenced by culture, for example cultures with a direct communication style.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Students have to complete a stay abroad before, during or outside of their studies. Further information which possibilities can be accepted: https://www.wi.tum.de/downloads/#program=1295.

Content:
This module gives an introduction to basic theoretical knowledge in scientific conceptualisation of culture, cultural differences and difficulties as well as their overcoming. During the module common scientific definition of culture and common scientific approaches of cultural dimensions are explained. By exemplifying cultural characteristics on the basis of selected case studies the module shows how people with different cultural background interact and how to deal with these differences. Additionally, basic theoretical knowledge in intercultural communication is provided. For example, it is explained how to deal with different communication styles of different cultures and how to communicate adequately in an international context. For this purpose, selected cultural characteristics and practical examples are used.

Intended Learning Outcomes:
After attending this module, students are able to describe basic scientific approaches to culture and cultural differences. On basis of general knowledge about cultural theories, particular cultures, as well as general knowledge about the issues occurring when people with different cultural backgrounds interact the students are able to explain cultural differences and difficulties in an intercultural business context. Additionally, students are able to define different communication styles in different cultures and to explain how those can influence intercultural communication situations. Students are also able to reflect their experience abroad and develop an open-mindedness and sensitivity with respect to cultural differences.
The module is created as a self-study of given scientific literature, for example scientific essays and book chapters. The literature covers various thematic areas, for example cultural models and cultural issues in business and communication. Practice questions for exam preparation are also provided.

**Teaching and Learning Methods:**
The module is created as a self-study of given scientific literature, for example scientific essays and book chapters. The literature covers various thematic areas, for example cultural models and cultural issues in business and communication. Practice questions for exam preparation are also provided.

**Media:**
Scientific literature, digital scripts (Power Point slides, PDF files), videos and study questions for the exam preparation.

**Reading List:**

Further literature will be provided during the course.

**Responsible for Module:**
Moog, Martin; Prof. Dr.

**Courses (Type of course, Weekly hours per semester), Instructor:**
International Experience (WI001197) (lecture, 2 SWS)
Heinze S, Moog M, Oesingmann K

For further information in this module, please click campus.tum.de or here.
Module Description

WI001198: Communication Skills

TUM School of Management

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<th>Module Level:</th>
<th>Language:</th>
<th>Duration:</th>
<th>Frequency:</th>
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<td>Bachelor</td>
<td>German/English</td>
<td>one semester</td>
<td>winter/summer semester</td>
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Credits:*  Total Hours:  Self-study Hours:  Contact Hours:
3  90  30  60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Students can choose between a number of courses addressing different communicative challenges. The examination is not graded (Studienleistung) and can be an oral assessment or a written exam. Please find detailed information regarding course examinations, content, learning outcomes, literature and teaching and learning methods in the individual course description (Lehrveranstaltungsbeschreibung) in TUMonline.

For example:
The oral assessment or presentation assess students' ability to transport their point of view in a comprehensible and well-structured manner. Students show that they can communicate scientific or business issues in a careful but effective way. They communicatively create a situation of mutuality independent of culture-specific particularities. Answering questions students show that they can advocate their angle on a topic using communication methods.

Please find the up-to-date information in which courses students may earn credits under the following link under communication skills: https://www.wi.tum.de/programs/bachelor-in-mt/downloads/.

Repeat Examination:
Next semester

(Recommended) Prerequisites:

Content:
Students can choose between a number of courses addressing different communicative challenges:

(1) Presentation & Moderation Techniques:
- use and effect of voice, language and body language
- managing the impact on employees and customers
- defining explicit goals and objectives
- responsibilities, role and self-perception of an facilitator
- strategies how to conduct a fruitful discussion

(2) Conflict Management & Conduct of Negotiations
- conflict types
- causes and development of conflicts
- systematic conflict analysis (e.g. stages of escalation after Glasi)
- conflict patterns
- concepts of negotiation strategies,
- conflict de-escalation

(3) Business Plan
- developing a business plan
- assessment of business ideas
- analyzing market & competition
- pitching business idea

(4) Intercultural Communication
- share information across different cultures and social groups
- interact with people from other cultures
- understand customs from people of different countries

(5) Language Courses
(offered by TUM Language Center or courses completed abroad equivalent to 3 ECTS)
- learn a foreign language
- be more open to another culture
- assessment of business ideas; analysing market & competition

Intended Learning Outcomes:
Upon successful completion of the module students are able to (1) efficiently and appropriately communicate business and scientific topics to others such as employees or an audience. (2) They are able to present and discuss complex issues referring to a scientific basis within groups or in front of an audience and (3) lead a discussion. Furthermore, they are able to (4) tackle conflict situations and (5) manage to communicatively find a solution.

Teaching and Learning Methods:
To sharpen their communication skills the focus in these courses is to practice in different situations and settings. Depending on the selected course, students will e.g. hold short presentations, pitches or exercise in role-plays. To deepen and strengthen these learning experiences peers and instructors will give immediate feedback.

Media:
PowerPoint slides, moodle, videos, online learning materials

Reading List:
- Ant, Marc; Nimmerfroh, Maria Christina; Reinhard, Christina (2014); Effiziente Kommunikation - Theorie und Praxis am Beispiel ¿Die 12 Geschworenen¿; Springer Gabler
- Alan Barker (2013); Improve Your Communication Skills; Kogan Page Publishers

Responsible for Module:
Moog, Martin; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Introduction to Communication and Presentation Skills (seminar, 2 SWS)
Benzinger D

Business Plan - Basic Course (Business Idea and Market) (seminar, 2 SWS)
Böhler D [L], Böhler D, Heyde F

Presentation Techniques (WI000252) (seminar, 2 SWS)
Cavalieri I, Schwarzack S, Thiel M

Conflict Management and Conduct of Negotiation (WI000253) (seminar, 2 SWS)
Hörtlackner R, Strohmeyer U, Thiel M

For further information in this module, please click campus.tum.de or here.
Module Description

WI000693: Bachelor's Thesis

TUM School of Management

<table>
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<th>Language:</th>
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<td>360</td>
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Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The Bachelor's Thesis is a final paper with a duration of 3 months, where the students concentrate on a specific topic in business administration and economics. Here the students frame the state of research and discourse and evolve the own specific topic. Based on scientific knowledge and methodical skills, students autonomously describe the topic. The Bachelor's Thesis is supported by a professor of the TUM School of Management.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
The Thesis can be filed after the successful completion of 87 Credits in the basics of business administration and the project study.

Content:
The Bachelor's Thesis focuses on a research topic in business administration and economics, usually at the interface to engineering and natural sciences. The Thesis is always supervised by a professor of TUM School of Management, often in co-operation with an organization of industry or research. The topic of the Thesis is created so that it can be treated extensively within three months.

Intended Learning Outcomes:
At the end of the module “Bachelor's Thesis” students are able to handle and develop a project in an autonomic, systematic and scientific way. Therefore the students deploy scientific knowledge and methodical skills to the specific subject. They script the state-of-the-art knowledge, based on research, and classify the findings within the scientific and/or practical discussion. The students are able to cope with new and complex subjects in an autonomous way.

Teaching and Learning Methods:
The creation of the thesis encourages the students to deal soundly with a scientific subject. Therefore they apply the knowledge and methodical skills, acquired during the studies, and create an elaborated scientific documentation within the set time frame.

Media:
literature, presentations

Reading List:
specific literature based on the topic
Responsible for Module:
Ernstberger, Jürgen; Prof. Dr. rer. pol. habil.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.
### Index

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>[WI000026]</td>
<td>Advanced Technology and Innovation Management</td>
<td>223 - 224</td>
</tr>
<tr>
<td>[CH0107]</td>
<td>Analytical Chemistry</td>
<td>71 - 72</td>
</tr>
<tr>
<td>[EI0602]</td>
<td>Audio Communication</td>
<td>122 - 123</td>
</tr>
<tr>
<td>[20191]</td>
<td>Bachelor's Program in Management &amp; Technology</td>
<td>7</td>
</tr>
<tr>
<td>[WI000693]</td>
<td>Bachelor's Thesis</td>
<td>280</td>
</tr>
<tr>
<td></td>
<td>Basic Courses (18 Cr have to be passed till the end of the 2nd semester)</td>
<td>8</td>
</tr>
<tr>
<td>[WI001028]</td>
<td>Basic Principles and international Aspects of Corporate Management</td>
<td>233 - 234</td>
</tr>
<tr>
<td>[CH1091]</td>
<td>Basic Principles of Physical Chemistry 1</td>
<td>82 - 83</td>
</tr>
<tr>
<td>[IN0009]</td>
<td>Basic Principles: Operating Systems and System Software</td>
<td>96 - 97</td>
</tr>
<tr>
<td>Basics</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Basics in Economics</td>
<td></td>
<td>51</td>
</tr>
<tr>
<td>Basics in Law</td>
<td></td>
<td>56</td>
</tr>
<tr>
<td>Basics in Management</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>[WZS0014]</td>
<td>Basics Plant Growing</td>
<td>269 - 270</td>
</tr>
<tr>
<td>[CH0106]</td>
<td>Biology for Chemists</td>
<td>69 - 70</td>
</tr>
<tr>
<td>[WZ8057]</td>
<td>Biology Part 1</td>
<td>197 - 198</td>
</tr>
<tr>
<td>[MW1903]</td>
<td>Bioprocess Engineering</td>
<td>144 - 145</td>
</tr>
<tr>
<td>Business Law</td>
<td></td>
<td>57</td>
</tr>
<tr>
<td>Business Law (E)</td>
<td></td>
<td>62</td>
</tr>
<tr>
<td>[MW2385]</td>
<td>CAD and Machines Drawing (Specialization/Application Area) [CADundMZ]</td>
<td>138 - 140</td>
</tr>
<tr>
<td>[CH1123]</td>
<td>Chemical Engineering for TUM-BWL</td>
<td>84 - 85</td>
</tr>
<tr>
<td>[CH1000]</td>
<td>Chemical Laboratory Course for TUM-BWL</td>
<td>77 - 79</td>
</tr>
<tr>
<td>Chemistry</td>
<td></td>
<td>216</td>
</tr>
<tr>
<td>[MEDWI001]</td>
<td>Chemistry - Basic knowledge with clinical links</td>
<td>195 - 196</td>
</tr>
<tr>
<td>[CH0999]</td>
<td>Chemistry Software and Databases for TUM-BWL</td>
<td>75 - 76</td>
</tr>
<tr>
<td>[WI001198]</td>
<td>Communication Skills</td>
<td>277 - 279</td>
</tr>
<tr>
<td>[SG120020]</td>
<td>Composition and Function of the Human Body</td>
<td>199 - 200</td>
</tr>
<tr>
<td>Computer Engineering</td>
<td></td>
<td>219</td>
</tr>
<tr>
<td>[EI5183]</td>
<td>Control Theory (MSE)</td>
<td>155 - 156</td>
</tr>
<tr>
<td>[WI001083]</td>
<td>Controlling</td>
<td>247 - 248</td>
</tr>
<tr>
<td>[WI000091]</td>
<td>Corporate Finance</td>
<td>245 - 246</td>
</tr>
<tr>
<td>[WI001057_E]</td>
<td>Cost Accounting</td>
<td>29 - 30</td>
</tr>
</tbody>
</table>
Cost Accounting

[W0001057] Cost Accounting 26

(IN2339) Data Analysis and Visualization in R 167 - 168

Economics & Policy

Economics I 271


[W000023_E] Economics II - Macroeconomics 10 - 11


Elective Modules Electrical Engineering and Information Technology 121

Elective Modules Informatics 100

Elective Modules Mechanical Engineering 143

Elective Modules Renewable Resources 189

Electives in Management and/or Technology 215

[W000015] Electrical Engineering 192 - 193

[El1289] Electrical Engineering 111 - 112

Electrical Engineering and Information Technology 254


[W0001192] Evidence Based Decisions Using Big Data Analytics [EEBDA] 235 - 236

Finance and Accounting 244


Financial Accounting and Reporting 21

[W0001059] Financial Accounting and Reporting 22 - 23

[W000005] Forestry and Wood 185 - 186

[W000005] Forestry and Wood 267 - 268

[W0001058] Foundations of Entrepreneurial & Ethical Business 43 - 45

[IN0003] Functional Programming and Verification 101 - 102

[IN0003] Functional Programming and Verification 157 - 158

[IN0008] Fundamentals of Databases 94 - 95

[IN0002] Fundamentals of Programming (Exercises & Laboratory) 90 - 91

[CS0077] Fundamentals of Thermodynamics 177 - 178


[CH0575] General and Inorganic Chemistry [CH0575] 73 - 74


[SG120025] Human Biology 201 - 202
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN8024</td>
<td>Information Management for Digital Business Models</td>
<td>98 - 99</td>
</tr>
<tr>
<td>IN8024</td>
<td>Information Management for Digital Business Models</td>
<td>171 - 172</td>
</tr>
<tr>
<td></td>
<td>Innovation and Entrepreneurship</td>
<td>222</td>
</tr>
<tr>
<td>WI000285</td>
<td>Innovative Entrepreneurs - Leadership of High-Tech Organizations</td>
<td>225 - 227</td>
</tr>
<tr>
<td>WI001143</td>
<td>Intellectual Property Management in the Global Market Place</td>
<td>228 - 229</td>
</tr>
<tr>
<td>WI001197</td>
<td>International Experience</td>
<td>275 - 276</td>
</tr>
<tr>
<td></td>
<td>International Experience &amp; Communication Skills</td>
<td>274</td>
</tr>
<tr>
<td>WZS0006</td>
<td>Introduction into Computer Science</td>
<td>187 - 188</td>
</tr>
<tr>
<td>IN8005</td>
<td>Introduction into Computer Science (for non Informatics studies)</td>
<td>210 - 211</td>
</tr>
<tr>
<td>IN8005</td>
<td>Introduction into Computer Science (for non Informatics studies)</td>
<td>117 - 118</td>
</tr>
<tr>
<td>IN8005</td>
<td>Introduction into Computer Science (for non Informatics studies)</td>
<td>130 - 131</td>
</tr>
<tr>
<td>IN8005</td>
<td>Introduction into Computer Science (for non Informatics studies)</td>
<td>169 - 170</td>
</tr>
<tr>
<td>IN0001</td>
<td>Introduction to Informatics 1</td>
<td>88 - 89</td>
</tr>
<tr>
<td>IN0001</td>
<td>Introduction to Informatics 1</td>
<td>252 - 253</td>
</tr>
<tr>
<td>CH1090</td>
<td>Introduction to Organic Chemistry</td>
<td>80 - 81</td>
</tr>
<tr>
<td>IN0006</td>
<td>Introduction to Software Engineering</td>
<td>159 - 160</td>
</tr>
<tr>
<td>IN0006</td>
<td>Introduction to Software Engineering</td>
<td>92 - 93</td>
</tr>
<tr>
<td>WI000219</td>
<td>Investment and Financial Management</td>
<td>32 - 33</td>
</tr>
<tr>
<td>WI000219_E</td>
<td>Investment and Financial Management</td>
<td>34 - 35</td>
</tr>
<tr>
<td></td>
<td>Investment and Financial Management</td>
<td>31</td>
</tr>
<tr>
<td>WI001108</td>
<td>Law of Business Association 2</td>
<td>249 - 250</td>
</tr>
<tr>
<td>WI000275_E</td>
<td>Management Science [MS]</td>
<td>18 - 19</td>
</tr>
<tr>
<td>WI000820</td>
<td>Marketing and Innovation Management</td>
<td>40 - 42</td>
</tr>
<tr>
<td></td>
<td>Marketing, Strategy and Leadership</td>
<td>230</td>
</tr>
<tr>
<td>BV350007</td>
<td>Materials in Mechanical Engineering</td>
<td>128 - 129</td>
</tr>
<tr>
<td>MA9714</td>
<td>Mathematics in Natural and Economic Science 2 [MBNW 2]</td>
<td>119 - 120</td>
</tr>
<tr>
<td></td>
<td>Mechanical Engineering</td>
<td>261</td>
</tr>
<tr>
<td>MEDWI003</td>
<td>Medical Focus</td>
<td>205 - 207</td>
</tr>
<tr>
<td>MEDWI004</td>
<td>Medical Science and Practice</td>
<td>208 - 209</td>
</tr>
<tr>
<td>MEDWI002</td>
<td>Medical terminology</td>
<td>203 - 204</td>
</tr>
<tr>
<td>MW2156</td>
<td>Metal-cutting Manufacturing Processes [SFV]</td>
<td>146 - 147</td>
</tr>
<tr>
<td>IN2161</td>
<td>Networks for Monetary Transactions</td>
<td>165 - 166</td>
</tr>
<tr>
<td></td>
<td>Operations and Supply Chain Management</td>
<td>237</td>
</tr>
<tr>
<td>WZS0003</td>
<td>Organic Chemistry</td>
<td>183 - 184</td>
</tr>
<tr>
<td>EI0644</td>
<td>Photovoltaic Stand Alone Systems [PVI]</td>
<td>255 - 256</td>
</tr>
</tbody>
</table>
Photovoltaic Stand Alone Systems  [PVI]  124 - 125
Physical Chemistry  190 - 191
Physics  179 - 180
Principles of Electrotechnology  [PiET]  257 - 258
Principles of Electrotechnology  [PiET]  151 - 152
Principles of Electrotechnology  [PiET]  107 - 108
Principles of Engineering Design and Production Systems  [GEP]  141 - 142
Principles of Information Engineering  113 - 114
Principles of Information Engineering  [PIE]  220 - 221
Principles of Information Engineering  [PIE]  149 - 150
Production and Logistics  46 - 47
Programming Languages  161 - 162
Project Management  240 - 241
Project Studies  212
Project Studies  213 - 214
Renewable Resources  266
Required Modules Electrical Engineering and Information Technology  106
Required Modules Informatics  87
Required Modules Mechanical Engineering  127
Required Modules Renewable Resources  176
Specialization in Technology  67
Specialization in Technology: Chemistry  68
Specialization in Technology: Computer Engineering  148
Specialization in Technology: Electrical Engineering and Information Technology  105
Specialization in Technology: Informatics  86
Specialization in Technology: Mechanical Engineering  126
Specialization in Technology: Medical Science  194
Specialization in Technology: Renewable Resources  175
Statistics for Business Administration  16 - 17
Strategic and International Management & Organizational Behavior  48 - 50
Telecommunication I - Signal Representation  115 - 116
Topics in Operations & Supply Chain Management I  [TPLS-I]  238 - 239
Transportation Logistics  242 - 243
User Modeling and Recommender Systems  103 - 104
User Modeling and Recommender Systems  163 - 164