TUM School of Management
Technische Universität München

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 of module handbook descriptions (SPO tree)

Alphabetical index can be found on page 212

Basics | Grundlagen

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

Economics I | Volkswirtschaftslehre I

Module Description

WI000021: Economics I - Microeconomics | Volkswirtschaftslehre I - Mikroökonomie [ECON 1]

Microeconomics

Version of module description: Gültig ab summerterm 2021

Module Level: Bachelor	**Language:** German/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:
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 positition 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 accompaying 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:
Robert S. Pindyck and David L. Rubinfeld, Microeconomics, 8th Edition, Pearson, 2013 (ISBN 13: 978-0-13-285712-3). AND Robert S. Pindyck und David L. Rubinfeld, Mikroökonomie, 8. Aufl., Pearson Studium, 2013 (ISBN-13: 978-3868941678).

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

Courses (Type of course, Weekly hours per semester), Instructor:
Economics I - Übung (WI000021) am Campus Straubing (Übung, 2 SWS)
Drobner C, Goerg S

Economics I - Übung (WI000021) am Campus Straubing (Übung, 2 SWS)
Drobner C, Goerg S

Economics I (WI000021) am Campus Straubing (Microeconomics) (Vorlesung, 2 SWS)
Goerg S

Economics I (WI000021) am Campus Straubing (Microeconomics) (Vorlesung, 2 SWS)
Goerg S
For further information in this module, please click campus.tum.de or here.

Module Description

WI000021_E: Economics I - Microeconomics | Economics I - Microeconomics [ECON 1]

Microeconomics

Version of module description: Gültig ab summerterm 2021

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:
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 positition 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 accompaying 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:
Robert S. Pindyck and David L. Rubinfeld, Microeconomics, 8th Edition, Pearson, 2013 (ISBN 13: 978-0-13-285712-3). AND Robert S. Pindyck und David L. Rubinfeld, Mikroökonomie, 8. Aufl., Pearson Studium, 2013 (ISBN-13: 978-3868941678).

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

Courses (Type of course, Weekly hours per semester), Instructor:
Economics I (WI000021_E) - English (Microeconomics) (Vorlesung, 2 SWS)
Kurschilgen M (Drobner C, Inderst F, Mukherjee A, Strobel M)

Economics I Exercise - English (WI000021_E): (BSc English Track) (Übung, 2 SWS)
Mukherjee A, Strobel M
For further information in this module, please click campus.tum.de or here.

Module Description

MA9711: Mathematics in Natural and Economic Science 1 | Mathematische Behandlung der Natur- und Wirtschaftswissenschaften 1

Version of module description: Gültig ab summerterm 2021

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:
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:
- N. Henze, G. Last: Mathematik für Wirtschaftsingenieure 1, 2. Aufl., Vieweg, 2005.
- G. Merziger, T. Wirth: Repetitorium der höheren Mathematik. Binomi, 1999.
- K. Meyberg, P. Vachenauer: Höhere Mathematik 1+2. Springer, 2001.
- O. Opitz: Mathematik. Lehrbuch für Ökonomen. Oldenbourg, 2002.
- M. Precht, K. Voit, R. Kraft: Mathematik für Nichtmathematiker 1+2. Oldenbourg, 1994.
- F. Pfuff: Mathematik für Wirtschaftswissenschaftler 1: Grundzüge der Analysis - Funktionen einer Variablen. 5. Aufl.,Vieweg, 2008.
- H. Pruscha, D. Rost: Mathematik für Naturwissenschaftler. Springer, 2008.
- L. Rade, B. Westergren, P. Vachenauer: Springers mathematische Formeln. Springer, 2000.
- J. Tietze: Einführung in die angewandte Wirtschaftsmathematik. 15. Aufl., Vieweg, 2009.
- K. Sydsaeter, O. Hammond: Mathematik für Wirtschaftswissenschaftler. 2. Aufl., Pearson, 2006.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Übung zu Mathematische Behandlung der Natur- und Wirtschaftswissenschaften (Mathematik 1) [MA9711] (Übung, 2 SWS)
Ritter M

Vertiefungsübungen zu Mathematische Behandlung der Natur- und Wirtschaftswissenschaften (Mathematik 1)[MA9711] (Übung, 2 SWS)
Ritter M

Mathematische Behandlung der Natur- und Wirtschaftswissenschaften (Mathematik 1) [MA9711] (Vorlesung, 4 SWS)
Ritter M
For further information in this module, please click campus.tum.de or here.

Module Description

MA9712: Statistics for Business Administration | Statistik für BWL

Version of module description: Gültig ab winterterm 2021/22

Module Level: Bachelor	**Language:** English	**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 module examination is based on a written exam (90 minutes). Students have to know basic terms and concepts of statistics and probility 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:
[1] Caputo, A., Fahrmeir, L., Künster, R., Lang, S., Pigeot, I., Tutz, G (2009). Arbeitsbuch Statistik. Springer.
[2] Cramer, E., Kamps, U. (2007). Grundlagen der Wahrscheinlichkeitsrechnung und Statistik, Springer.
[3] Diesz, D., Barr, C., and Cetinkaya-Rundel, M. (2015). OpenIntro Statistics, 3rd edition, https://www.openintro.org/stat/textbook.php
[4] Fahrmeir, L., Künster, R., Pigeot, I., Tutz, G. (2009). Statistik: Der Weg zur Datenanalyse. Springer.
[5] Field, A., Miles, J. and Field, Z. (2012). Discovering Statistics Using R. SAGE.
[6] Verzani, J. (2004). Using R for Introductory Statistics. Chapman & Hall.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Programming Exercises for Statistics for Business Administration [MA9712] (Übung, 1 SWS)
Zagst R, Fernandez L

Exercises for Statistics for Business Administration [MA9712] (Übung, 1 SWS)
Zagst R, Fernandez L

Statistics for Business Administration [MA9712] (Vorlesung, 3 SWS)
Zagst R, Fernandez L
For further information in this module, please click campus.tum.de or here.

Module Description

WI000275_E: Management Science | Management Science [MS]

Version of module description: Gültig ab summerterm 2021

Module Level: Bachelor	**Language:** German/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:
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 definend in the German Abitur

Content:
Management Science is about modeling, solving and analyzing planning and decision problems using mathematial 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, Netwerk 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.

Media:
Script, Presentation slides

Reading List:
Bradley, S.P., A.C. Hax und T.L. Magnanti: Applied Mathematical Programming, Addison-Wesley, 1977. Domschke W and A. Drexl: Einführung in Operations Research, 9th Ed., Springer, 2015.
Hillier FS and Lieberman GJ: Introduction to Operations Research, 9th ed., McGraw-Hill, 2010.
Winston WL: Operations Research, 5th Ed., Thomson, 2004.
Hillier FS and Lieberman GJ: Introduction to Operations Research, 9th ed., McGraw-Hill, 2010.
Winston WL: Operations Research, 5th Ed., Thomson, 2004.

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

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

Management Science (WI000275_E) am Campus Straubing (Vorlesung, 2 SWS)
Ostermeier M, Roth B

Management Science Übung (WI000275_E) am Campus Straubing (Übung, 2 SWS)
Ostermeier M, Roth B

Management Science Übung (WI000275_E) (Übung, 2 SWS)
Weber H
For further information in this module, please click campus.tum.de or here.

Basics in Management | Betriebswirtschaftliche Grundlagen

Cost Accounting | Kostenrechnung

Module Description

WI001057: Cost Accounting | Kostenrechnung

Version of module description: Gültig ab summerterm 2021

Module Level: Bachelor/Master	**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 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:
Friedl, Gunther; Hofmann, Christian; Pedell, Burkhard: Kostenrechnung - Eine entscheidungsorientierte Einführung, 2nd edition, München 2013.
Küpper, Hans-Ulrich; Friedl, Gunther; Hofmann, Christian; Pedell, Burkhard: Übungsbuch zur Kosten- und Erlösrechnung, 6th edition,
München 2010.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Kostenrechnung (WI001057): Übung (Bachelor TUM-BWL) (Übung, 2 SWS)
Friedl G [L], Blaschke M

Kostenrechnung (WI001057) (Bachelor TUM-BWL) am Campus Straubing (Vorlesung, 2 SWS)
Röder H [L], Hertl I
For further information in this module, please click campus.tum.de or here.

Module Description

WI001057_E: Cost Accounting | Cost Accounting

Version of module description: Gültig ab summerterm 2021

Module Level: Bachelor	**Language:** English	**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 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:
Friedl, Gunther; Hofmann, Christian; Pedell, Burkhard: Kostenrechnung - Eine entscheidungsorientierte Einführung, 2nd edition, München 2013.
Küpper, Hans-Ulrich; Friedl, Gunther; Hofmann, Christian; Pedell, Burkhard: Übungsbuch zur Kosten- und Erlösrechnung, 6th edition,
München 2010.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Cost Accounting (WI001057_E): Exercise (Bachelor TUM-BWL) (Übung, 2 SWS)
Friedl G [L], Doetsch A, Mehrer M, Schoonjans E

Cost Accounting (WI001057_E) (Bachelor TUM-BWL) (Vorlesung, 2 SWS)
Friedl G [L], Mehrer M, Schoonjans E
For further information in this module, please click campus.tum.de or here.

Investment and Financial Management | Investitions- und Finanzmanagement

Module Description

WI000219: Investment and Financial Management | Investitions- und Finanzmanagement

Version of module description: Gültig ab summerterm 2021

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 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 exapmle have to analyse investment projects, create the optimal capital stucture of projects or firms, evaluate bonds, stocks, or equity options.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
none

Content:
The module will give students a braod 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 profut 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.
- Excercise 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, onlineTED

Reading List:
Berk/DeMarzo, Corporate Finance, 3rd. Edition, Pearson.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Investitions- und Finanzmanagement: Einführung in Finanzmärkte (WI000219) (Übung, 2 SWS)
Kaserer C (Knauer L)

Investitions- und Finanzmanagement: Einführung in Corporate Finance (WI000219) (Vorlesung, 2 SWS)
Kaserer C (Knauer L)

Investitions- und Finanzmanagement (WI000219) am Campus Straubing (Vorlesung, 2 SWS)
Maniora J [L], Hertl I, Maniora J

Finanzmathematik - Übung (WI000219) am Campus Straubing (Übung, 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 | Investment and Financial Management

Version of module description: Gültig ab summerterm 2021

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:
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 exapmle have to analyse investment projects, create the optimal capital stucture 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 braod 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 profut 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.
- Excercise 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.

Media:
Presentations, exercises with solutions, onlineTED

Reading List:
Berk/DeMarzo, Corporate Finance, 3rd. Edition, Pearson.

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) (Vorlesung, 2 SWS)
Braun R [L], Braun R, Weik S

Investment and Financial Management: Introduction to Financial Markets (WI000219_E) (Übung, 2 SWS)
Braun R [L], Weik S
For further information in this module, please click campus.tum.de or here.

Module Description

WI000261: Empirical Research Methods | Empirical Research Methods [ERM]

Version of module description: Gültig ab summerterm 2021

Module Level: Bachelor	**Language:** German/English	**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:
Exam
Grading is based on a 100% multipe-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 (Mid term 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 analysys & 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.
Excercises 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 excercises 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):
- Singleton, R. A., Straits, B. C., & Straits M. M.1993 (or newer). Approaches to Social Research (=/> 2nd ed.). Oxford University Press. (Abbreviated "ASR" in preparation sheets)
- In German: Backhaus, K., Erichson, B., Plinke, W., & Weiber, R. 2010 (or newer). Multivariate Analyse¬methoden: Eine anwendungsorientierte Einführung (=/> 13th ed.). Berlin: Springer.
- Salkind, N.J. 2008 (or newer)). Statistics for people who think they hate statistics (=/> 3rd ed.). Thousand Oaks, CA: Sage.
- Hair, J. F., Jr., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. 2005 (or newer. Multivariate data analysis (=/> 6th ed.). Upper Saddle River, NJ: Prentice Hall.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Empirical Research Methods (WI000261) (Vorlesung, 2 SWS)
Granulo A

Empirical Research Methods (WI000261) (Vorlesung, 2 SWS)
Granulo A

Empirical Research Methods (WI000261): Exercise (Übung, 2 SWS)
Granulo A

Empirical Research Methods (WI000261): Exercise (Übung, 2 SWS)
Granulo A
For further information in this module, please click campus.tum.de or here.

Module Description

WI000820: Marketing and Innovation Management | Marketing and Innovation Management

Version of module description: Gültig ab summerterm 2021

Module Level: Bachelor	**Language:** German/English	**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 grading will be based on a written exam (120 min). By answering multiple choiche 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 asses 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., promotors 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 promotors
- Kotler/Keller/Brady/Goldman/Hansen (2012): Marketing Management, 2nd European ed., Pearson: Harlow.
- Kotler/Armstrong (2014): Principles of Marketing, 15th ed., Pearson: Harlow.
- Homburg (2015): Marketingmanagement. Strategie - Instrumente - Umsetzung - Unternehmensführung, 5. Aufl., Gabler: Wiesbaden.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Technology and Innovation Management: Introduction (WI000820) am Campus Straubing (Bachelor TUM-BWL) (Vorlesung, 2 SWS)
Doblinger C [L], Doblinger C, Kurowski S, Henkel J, Perlinger K

Technology and Innovation Management: Introduction (WI000820) am Campus Straubing (Bachelor TUM-BWL) (Vorlesung, 2 SWS)
Doblinger C [L], Doblinger C, Kurowski S, Henkel J, Perlinger K

Marketing (WI000820) am Campus Straubing (Bachelor TUM-BWL) (Vorlesung, 2 SWS)
Menrad K [L], Menrad K

Marketing (WI000820) am Campus Straubing (Bachelor TUM-BWL) (Vorlesung, 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 | Foundations of Entrepreneurial & Ethical Business

Version of module description: Gültig ab summerterm 2021

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:
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 equiped 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 appoaches 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:
Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2010). Entrepreneurship (8th ed.). New York: McGraw-Hill.
Read, S., Sarasvathy, S., Dew, N., Wiltbank, R. & Ohlsson, A.-V. (2010). Effectual Entrepreneurship. New York: Routledge Chapman & Hall.
Karl Homann/Christoph Lütge: Einführung in die Wirtschaftsethik,2. Aufl., Münster 2005.
Andrew Crane/Dirk

Matten: BusinessEthics: A European Perspective, Oxford 2003.
Karl Homann/Franz Blome-Drees: Wirtschaftsund
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") am Campus Straubing (Vorlesung, 2 SWS)
Doblinger C, Fischer D

Einführung in die Wirtschaftsethik (WI001058, WI101058) (Part II of Module "Foundations of Entrepreneurial and Ethical Business") am Campus Straubing (Vorlesung, 2 SWS)
Doblinger C, Kurowski S

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

Introduction to Entrepreneurship (WI001058, WI101058) (Part I of Module "Foundations of Entrepreneurial and Ethical Business") (Vorlesung, 2 SWS)
Patzelt H [L], Baur C, Patzelt H
For further information in this module, please click campus.tum.de or here.

Module Description

WI001059_E: Financial Accounting | Financial Accounting

Version of module description: Gültig ab summerterm 2021

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:
Current notice: Due to the CoViD19-pandemic, the exam for this summer semester 2020 has been adjusted.
The examination of the students' success consists of a written online exam, Online Proctored Exam. 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) (Vorlesung mit integrierten Übungen, 4 SWS)
Ernstberger J, Grottel B, Keiling M
For further information in this module, please click campus.tum.de or here.

Module Description

WI001060: Production and Logistics | Production and Logistics

Version of module description: Gültig ab summerterm 2021

Module Level: Bachelor	**Language:** German/English	**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 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:
Günther, H.O., Tempelmeier, H. (2012), Produktion und Logistik, 9. Auflage, Springer

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

Courses (Type of course, Weekly hours per semester), Instructor:
Production Management (WI001060) (TUM-BWL Bachelor) (Vorlesung, 2 SWS)
Grunow M [L], Grunow M (Pahr A), Kreitz F

Logistik und Supply Chain Management (WI001060) (Vorlesung, 2 SWS)
Minner S (Bloemer A, Svoboda J)
For further information in this module, please click campus.tum.de or here.

Module Description

WI001121: Strategic and International Management & Organizational Behavior | Strategic and International Management & Organizational Behavior

Version of module description: Gültig ab summerterm 2021

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:
Cavusgil, S.T., Knight, G., Riesenberger, J. R. (2008), International Business: strategy, management, and the new realities
Hill, C.W.L. (2014), International business: Competing in the Global Marketplace
Landy, F.J., & Conte, J.M. (2013). Work in the 21st century. Hoboken, NJ: Wiley.
Wood, J. M. (2016). Organisational behavior: Core concepts and applications. Milton, Australia: Wiley.

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

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

Organizational Behavior (WI001121) am Campus Straubing (Vorlesung, 2 SWS)
Benzinger D, Cantner F, Goerg S

Strategic and International Management (WI001121) (Bachelor TUM-BWL) am Campus Straubing (Vorlesung, 2 SWS)
Doblinger C, Kurowski S

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

Basics in Economics | Volkswirtschaftliche Grundlagen

Module Description

WI000023: Economics II - Macroeconomics | Volkswirtschaftslehre II - Makroökonomie [VWL 2]

Macroeconomics

Version of module description: Gültig ab summerterm 2021

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 disequilibuium
- 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:
The CORE Project (2016): 'The Economy', in: Azm Premji University, Friends Provident Foundation, HM Treasury, Institute for New Economic Thinking, Open Society Foundations, SciencesPo, UCL (eds.), University College London.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Volkswirtschaftslehre II / Macroeconomics (WI000023 / CS0067) am Campus Straubing (Vorlesung, 2 SWS)
Pondorfer A [L], Pondorfer A

Übung zur Vorlesung Volkswirtschaftslehre II / Macroeconomics (WI000023 / CS0067) am Campus Straubing (Übung, 2 SWS)
Pondorfer A [L], Pondorfer A
For further information in this module, please click campus.tum.de or here.

Module Description

WI000023_E: Economics II - Macroeconomics | Economics II - Macroeconomics [VWL 2]

Macroeconomics

Version of module description: Gültig ab summerterm 2021

Module Level: Bachelor	**Language:** English	**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:
Current notice: Due to the continuing CoViD19-pandemic, the exam for this winter semester 2020/21 has been adjusted.
The examination is an online Moodle-Test.
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 disequilibuium
- 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:
The CORE Project (2016): 'The Economy', in: Azm Premji University, Friends Provident Foundation, HM Treasury, Institute for New Economic Thinking, Open Society Foundations, SciencesPo, UCL (eds.), University College London.

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

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

Economics II (WI000023_E): Exercise (Macroeconomics) (Übung, 2 SWS)
Mukherjee A
For further information in this module, please click campus.tum.de or here.

Basics in Law | Rechtswissenschaftliche Grundlagen

Business Law | Wirtschaftsprivatrecht

Module Description

WI000027: German Business Law I | Wirtschaftsprivatrecht I (inkl. jurist. Fallbearb.)

Version of module description: Gültig ab summerterm 2018

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:
Maume, Philipp; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Wirtschaftsprivatrecht 1 (WI000027) am Campus Straubing (Vorlesung, 2 SWS)
Koch J, Schönermark C, Weideneder N

Einführung in die juristische Fallbearbeitung, Teil 1 (Fälle zur Vorlesung Wirtschaftsprivatrecht 1) (WI000027) am Campus Straubing (Übung, 2 SWS)
Koch J, Schönermark C, Weideneder N

Wirtschaftsprivatrecht 1 (WI000027) (Vorlesung, 2 SWS)
Maume P

Einführung in die juristische Fallbearbeitung, Teil 1 (Fälle zur Vorlesung Wirtschaftsprivatrecht 1) (WI000027) (Übung, 2 SWS)
Schregle R, van der Linde T
For further information in this module, please click campus.tum.de or here.

Module Description

WI000030: German Business Law II | Wirtschaftsprivatrecht II (inkl. jurist. Fallbearb.)

Version of module description: Gültig ab summerterm 2018

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:
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 on 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.

Teaching and Learning Methods:
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, Wirtschaftsprivatrecht kompakt

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

Courses (Type of course, Weekly hours per semester), Instructor:
Wirtschaftsprivatrecht 2 (WI000030) am Campus Straubing (Vorlesung, 2 SWS)
Koch J, Schönermark C

Einführung in die juristische Fallbearbeitung, Teil 2 (Fälle zur Vorlesung Wirtschaftsprivatrecht 2) (WI000030) (Wiederholung aus Sommersemester) (Übung, 2 SWS)
Zimmermann P
For further information in this module, please click campus.tum.de or here.

Business Law (E) | Business Law (E)

Module Description

WI001119: Business Law I | Business Law I

Version of module description: Gültig ab winterterm 2019/20

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:
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:

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:
Robbers, An Introduction to German Law (6th ed., 2017)

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

Courses (Type of course, Weekly hours per semester), Instructor:
Business Law I - Case studies (WI001119) (Übung, 2 SWS)
Haffke L

Business Law I (WI001119) (Vorlesung, 2 SWS)
Maume P
For further information in this module, please click campus.tum.de or here.

Module Description

WI001120: Business Law II | Business Law II [BusLaw 2]

Version of module description: Gültig ab summerterm 2018

Module Level: Bachelor	**Language:** English	**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:
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 on overview of the laws of the European Union that are relevant for national and international businesses.
Topics covered are the oncept 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 restrains 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 (WI001120): Case studies (Übung, 2 SWS)
Katopodi E

Business Law II (WI001120) (Vorlesung, 2 SWS)
Maume P
For further information in this module, please click campus.tum.de or here.

Specialization in Technology | Technik-Schwerpunkt

Specialization in Technology: Chemistry | Technik-Schwerpunkt: Chemie

Module Description

CH0106: Biology for Chemists | Biologie für Chemiker

Version of module description: Gültig ab summerterm 2018

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
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:
Die Prüfungsleistung wird schriftlich in Form von einer 90-minütigen Klausur erbracht. In dieser soll nachgewiesen werden, dass in begrenzter Zeit und ohne Hilfsmittel die Lernergebnisse des Moduls (z.B. die Grundstruktur von Biomolekülen und der Zellaufbau; wichtige biochemische Vorgänge innerhalb einer Zelle; Beziehung zwischen der chemischen Struktur und der (biologisch / biochemischen) Wirkung von organischen Molekülen; Protein-Biosynthese sowie die Grundlagen der Evolution deren molekulare Grundlagen) wiedergegeben und Fragestellungen zum Inhalt des Moduls eigenständig bearbeitet werden können. Die Prüfungsfragen gehen über den gesamten Modulstoff. Die Antworten erfordern eigene Berechnungen und Formulierungen und können teilweise die Auswahl von vorgegebenen Mehrfachantworten beinhalten.

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:
Nach der erfolgreichen Teilnahme am Modul verstehen die Studierenden den Aufbau von organischen Verbindungen und die wichtigsten biochemischen Vorgänge innerhalb einer Zelle. Die Studierenden erinnern sich an den Aufbau von Zellen sowie an den Aufbau der für die Biochemie und organischen Chemie relevanten Stoffklassen und die chemischen funktionellen Gruppen. Die Studierenden verstehen die Beziehung zwischen der chemischen Struktur und der (biologisch/biochemischen) Wirkung von organischen Molekülen. Die Studierenden erinnern sich an die Protein-Biosynthese sowie die Grundlagen der Evolution und verstehen deren molekulare Grundlagen. Insgesamt haben die Studierenden nach der erfolgreichen Teilnahme am Modul einen Überblick über die strukturellen und funktionellen Grundzüge von Biomolekülen.

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. In 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:
Biologie für Chemiker (LV0058) (Vorlesung mit integrierten Übungen, 3 SWS)
Buchner J, Haslbeck M
For further information in this module, please click campus.tum.de or here.

Module Description

CH0107: Analytical Chemistry | Analytische Chemie

Version of module description: Gültig ab summerterm 2020

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:
Die Prüfungsleistung wird in Form einer Klausur (60 Minuten) erbracht. In dieser soll nachgewiesen werden, dass in begrenzter Zeit und ohne Hilfsmittel die verschiedenen Schritte moderner Analytik von der Probenahme bis zur Auswertung erkannt und gängige instrumentelle Analyseverfahren erinnert werden können. Die Antworten erfordern teils eigene Berechnungen und Formulierungen teils Ankreuzen von vorgegebenen Mehrfachantworten.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Grundwissen in Chemie und Physik.

Content:
Der Analytische Prozess: Probennahme, Probenvorbereitung, Detektions- und Bestimmungsverfahren, Validierung der Ergebnisse, Qualitätssicherung. Instrumentelle Analytik, u.a. AAS, OES, RFA, MS, Kopplungstechniken. Illustrative Beispiele moderner Elementanalytik.

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 Auseindersetzung mit der Thematik und zum Studium der Literatur angeregt.

Media:
Bücher, Online-Skript

Reading List:
Skoog, Douglas A., Holler, F. James, Crouch, Stanley R. Niessner, R. (Hrsg.), Instrumentelle Analytik Grundlagen - Geräte Anwendungen. Springer 2013, 6. Auflage.
Harris, Daniel C., Werner, Gerhard, Werner, Tobias (Hrsg.), Lehrbuch der Quantitativen Analyse. Springer 2014, 8. Auflage.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Analytische Chemie (LV0003) (Vorlesung, 2 SWS)
Schuster M (Urstöger A)
For further information in this module, please click campus.tum.de or here.

Module Description

CH0575: General and Inorganic Chemistry | Allgemeine und Anorganische Chemie

Version of module description: Gültig ab summerterm 2018

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:
Die Prüfungsleistung wird schriftlich in Form einer 90-minütigen Klausur erbracht. In dieser soll nachgewiesen werden, dass in begrenzter Zeit und ohne Hilfsmittel die grundlegenden Prinzipien der Allgemeinen und Anorganischen Chemie wiedergegeben und angewandt werden können. Die Bearbeitung der Klausur erfordert vorrangig eigenständig formulierte Antworten und Berechnungen. Dabei sollen sie z.B. Atombau und Struktur von kovalenten, ionischen und metallischen Verbindungen demonstriert erklären. Ferner sollen die Studierenden grundlegende Fragestellungen zu großtechnischen Prozessen zur Synthese von anorganischen Grundchemikalien beantworten und relevante Reaktionsgleichungen aufschreiben.

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:
Nach der erfolgreichen Teilnahme am Modul "Allgemeine und Anorganische Chemie" verstehen die Studierenden die wesentlichen Konzepte der allgemeinen und anorganischen Chemie und können sie auf einfache Beispiele selbständig anwenden. Die Studierenden verstehen den Aufbau des Periodensystems der Elemente und kennen das Vorkommen und die Herstellung der

wichtigsten Hauptgruppenelemente. Sie können Konzepte wie das Massenwirkungsgesetz, die Theorie der chemischen Bindung, Oxidation und Reduktion, die Reaktion von Säuren und Basen, die MO-Theorie etc. auf typische Beispiele anwenden und die Resultate analysieren. Sie kennen wichtige großtechnische Prozesse von anorganischen Grundchemikalien. Die Studierenden erinnern sich nach der Teilnahme an dem Modul auf Grund der vorgeführten Experimente an das chemische Verhalten der jeweiligen Elemente und deren Verbindungen.

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 und ausgesuchte Beispiele bearbeitet. Die zur Bearbeitung der Aufgaben notwendige Zeit wird dabei an die Erklärungsbedürfnisse der Studierenden angepasst. In die Vorlesung eingebundene Videos helfen ein besseres Verständnis bestimmter Konzepte und Versuchsabläufe zu erlangen. Experimentalvorführungen veranschaulichen die theoretisch besprochenen Inhalte und die Reaktivität der behandelten Stoffklassen und Elemente. Die Studierenden erhalten durch sie einen ersten Einblick in das experimentelle Arbeiten in einem chemischen Labor.
Zu den Lehreinheiten werden kapitelweise Übungsblätter und zeitversetzt die dazugehörigen Musterlösungen zur Verfügung gestellt. Dadurch setzen sich die Studierenden sowohl mit der eigenen Lösungsfindung, als auch mit den Musterlösungen auseinander und werden so auf die Prüfungsklausur vorbereitet.

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

Reading List:
- Riedel/Janiak Anorganische Chemie 9. Auflage 2015 (de Gruyter);
- M. Binnewies, Jäckel, H., Willner,G.,Rayner-Canham, M.,Allgemeine und Anorganische Chemie, Spektrum Akadem. Verlag;
- C. E. Mortimer, Das Basiswissen der Chemie, Georg Thieme Verlag Stuttgart New York.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Allgemeine und Anorganische Chemie (LV0166) (Vorlesung, 4 SWS)
Köhler K
For further information in this module, please click campus.tum.de or here.

Module Description

CH0999: Chemistry Software and Databases for TUM-BWL | Chemiesoftware und Datenbanken für TUM-BWL

Version of module description: Gültig ab summerterm 2018

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:
Die Überprüfung der Lernergebnisse erfolgt mittels Klausur (60 Minuten). Hierbei sollen die Studierenden zeigen, dass sie chemische Datenbanken verwenden und insbesondere eine (Sub-) Strukturformelsuche anwenden können. Die Studierenden verstehen, wie die einzelnen Datenbanken aufgebaut sind und analysieren, welche Datenbank für welche Fragestellung am besten geeignet ist. Sie verstehen die Grundprinzipien des Molecular Modeling und sie können die Suche nach einer Strukturformel mit minimaler Gesamtenergie anwenden. Die Fragen der Klausur beinhalten eigene Formulierungen und das zeichnen von Stukturformeln. Es sind keine Hilfsmittel erlaubt.

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:
Das Modul besteht aus einer Vorlesung und einer Übung. In der ersten Semesterhälfte erfolgt das Behandeln der theoretischen Modulinhalte mittels Vorlesung, danach die Festigung von gelerntem Wissen in der Übung als Blockkurs (1-2 Nachmittage).
Vorlesungen erfolgen als Präsentationen mittels Powerpoint zur anschaulichen Darstellung der Modulinhalte, das Skript ist für die Studierenden verfügbar (Downloadmöglichkeit für Vorlesungsmaterial). In der Übung wird mittels "Molecular Modelling"-Program und dem Versuchsskript erlerntes Wissen angewandt, gefestigt und eingeübt.

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:
Chemiesoftware und Datenbanken für TUM-BWL (LV0132) (Vorlesung mit integrierten Übungen, 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 | Chemisches Praktikum für TUM-BWL

Version of module description: Gültig ab summerterm 2021

Module Level: Bachelor	**Language:** German/English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 90	**Contact Hours:** 90

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

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 präparativen organischen Chemie und zu analytischen Methoden der organischen Chemie beherrschen.
Zur Überprüfung der handwerklich-praktischen Fähigkeiten beinhaltet die Laborleistung das Vorbereiten und Durchführen von 12-20 Versuchen aus den Bereichen der analytischen, anorganischen und organischen Chemie. Hierbei sollen die Studierenden zeigen, dass sie analytische und präparative Methoden theoretisch verstanden haben und sie praktisch durchführen können, z.B. Neutralisationstitration, Komplexometrie, Kationentrennungsgang, Anionennachweise, Elektrochemie, Wasseranalytik, NMR-Spektroskopie, Gaschromatographie, Massenspektrometrie sowie Destillation, Kristallisation, Extraktion und einfache Synthesen.
Des Weiteren beinhaltet die Laborleistung das Anfertigen von Versuchsprotokollen, das Führen eines Laborjournals, sowie die Durchführung von Vorbereitungs- und Ergebnisbesprechungen. Die Studierenden zeigen in den Protokollen, mit dem Laborjournal und in Vorbereitungs- und Ergebnisgesprächen, ob sie die erarbeiteten Informationen zu den genannten Themen beschreiben, interpretieren und auf ähnliche Sachverhalte übertragen können. Die Note der Laborleistung setzt sich zusammen aus: Versuchsdurchführung 41%, Versuchsprotokolle 28%, Führen des Laborjournals 7%, Vorbereitungs- und Ergebnisgespräche 24%.
In der Klausur soll nachgewiesen werden, dass in begrenzter Zeit und ohne Hilfsmittel grundlegende Probleme der analytischen und anorganischen Chemie sowie der organischen Chemie erkannt werden und Wege zu einer Lösung gefunden werden können. Die Prüfungsfragen gehen über den gesamten Modulstoff. Die Antworten erfordern teils eigene Berechnungen und Formulierungen, teils Ankreuzen von vorgegebenen Mehrfachantworten.

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 Modulinhalte:
- Behandlung grundlegender Konzepte der analytischen und anorganischen Chemie mit dem Ziel, die praktischen Versuchsbeobachtungen unterstützend verständlich zu machen: Säure-Base-Reaktionen, Löslichkeiten von Verbindungen, Redoxvorgänge, elektromagnetische Strahlung, Redoxvorgänge und Komplexchemie.
- Grundlagen der Reaktivität organischer Verbindungen mit dem Ziel, grundlegende Reaktionen der organischen Chemie unterstützend verständlich zu machen: Radikalische Substitution, nukleophile Substitution, Eliminierung, Addition, elektrophile aromatische Substitution, Reaktionen von Carbonylverbindungen.
- 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 einfache organische Verbindungen zu synthetisieren, sie zu analysieren und deren Reaktivität einzuschätzen.
Die Studierenden sind in der Lage, sowohl quantitative Bestimmungen von Analysen (Neutralisationstitration, Komplexometrie, Potentiometrie, Photometrie) als auch qualitative Bestimmungen von Analysen (Kationentrennungsgang, Anionennachweise) durchzuführen. Zudem sind sie in der Lage, Versuche zur Chemie aus Alltag und Technik (Elektrochemie, Wasseranalytik, Naturstoffextraktion, Polymerisation) durchzuführen.
Des Weiteren können die Studierenden präparative Grundoperationen (Destillation, Kristallisation, Extraktion) durchführen und analytische Methoden (NMR-Spektroskopie, Gaschromatographie,

Massenspektrometrie, Brechungsindexbestimmung, Siedepunkt- und Schmelzpunktbestimmung) anwenden. Die Bewertung der sicherheitsrelevanten Aspekte dieser einfachen Experimente können die Studierenden selbstständig durchführen.
Insbesondere sind die Studierenden in der Lage, Säure-Base-Reaktionen, Löslichkeiten von Verbindungen, Redoxvorgänge, elektromagnetische Strahlung, Redoxvorgänge und Komplexchemie zu verstehen. Zudem sind die Studierenden in der Lage, grundlegende Reaktionen der organischen Chemie aus den Themenbereichen radikalische Substitution, nukleophile Substitution, Eliminierung, Addition, elektrophile aromatische Substitution, und Reaktionen von Carbonylverbindungen zu verstehen. Darüber hinaus sind die Studierenden in der Lage, eine Literaturrecherche zu physikalischen Eigenschaften und spektroskopischen Daten von chemischen Verbindungen selbstständig durchzuführen und die grundlegende Interpretation von NMR- und Massenspektren zu verstehen. Zudem sind sie in der Lage, die den präparativen Grundoperationen und den analytischen Methoden zugrundeliegenden Theorien zu verstehen.

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 Versuchsdurchführung sowie die Ergebnisse und deren Auswertung und Interpretation werden in Form von Protokollen und Ausarbeitungen schriftlich festgehalten.
Die Inhalte des Seminars und der Übungen werden im Vortrag und durch Präsentation vermittelt. Die Studierenden sollen zur inhaltlichen Auseinandersetzung mit den Themen angeregt werden, sowie zum weiterführenden Studium der Literatur. In der Übung werden konkrete Beispiele zu den Inhalten des Seminars vertieft besprochen, sowie grundlegende Konzepte aus dem Seminar auf anders formulierte Probleme angewendet.

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

Reading List:
- K. Schwetlick, Organikum, 24. Aufl., Wiley-VCH, Weinheim, 2015
- S. Hünig, P. Kreitmeier, G. Märkl, J. Sauer, Arbeitsmethoden in der organischen Chemie, 1. Aufl., Lehmanns, Berlin, 2006
- E. Riedel, Anorganische Chemie, 4. Aufl., Walter de Gruyter, Berlin, 1999
- J. Stähle, E- Schweda, Lehrbuch der analytischen und präparativen anorganischen Chemie, Hirzel, Stuttgart, 1995.

Responsible for Module:
Bach, Nina; Dr. rer. nat.

Courses (Type of course, Weekly hours per semester), Instructor:
Chemisches Praktikum für TUM-BWL, Seminar (Seminar, 2 SWS)

Bach N

Chemisches Praktikum für TUM-BWL (Praktikum, 4 SWS)
Bach N
For further information in this module, please click campus.tum.de or here.

Module Description

CH1090: Introduction to Organic Chemistry | Einführung in die Organische Chemie

Version of module description: Gültig ab summerterm 2018

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:
Eine Prüfungsleistung wird in Form einer Klausur (90 Minuten) erbracht. In dieser soll nachgewiesen werden, dass in begrenzter Zeit und ohne Hilfsmittel ein Problem erkannt wird und Wege zu einer Lösung gefunden werden können. Dabei sollen die Studierenden zeigen, dass sie die organische Chemie wichtiger Verbindungen aus Natur und Technik bewerten können.
Sie verstehen Aufbauprinzipien und Eigenschaften der grundlegenden Naturstoffklassen. Die Studierenden sind vertraut mit den grundlegenden Reaktionsweisen organischer Verbindungen und können diese wiedergeben. Die Prüfungsfragen gehen über den gesamten Modulstoff.
Die Antworten erfordern teils eigene Berechnungen und Formulierungen teils Ankreuzen von vorgegebenen Mehrfachantworten.

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:
H. Beyer, W. Francke, W. Walter, "Lehrbuch der Organischen Chemie", lecture script

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

Courses (Type of course, Weekly hours per semester), Instructor:
Einführung in die Organische Chemie (LV0304) (Vorlesung, 3 SWS)
Fontain E

Einführung in die Organische Chemie, Übung (LV0304a) (Übung, 1 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 | Grundlagen der Physikalischen Chemie 1

Version of module description: Gültig ab summerterm 2018

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 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 developement) .
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, Herny'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.
7) Theoretical treatment of kinetics: Arrhenius law, theory of the transition 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 theorie and diversity is explained. Practice sheets containing specific Problems are ditributed 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:
P.W. Atkins u. J. de Paula, Physikalische Chemie, WILEY-VCH Verlag, 2006.
P.W. Atkins, C.A. Trapp,M.P. Cady, P. Marshall, C. Giunta. Arbeitsbuch Physikalische Chemie, WILEY-VCH Verlag, 2007.
J. Tinocio Jr. , K. Sauer, J.C. Wang, Physical Chemistry, Prentice Hall (1995).

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

Courses (Type of course, Weekly hours per semester), Instructor:
Grundlagen der Physikalischen Chemie 1 (LV0110) (Vorlesung, 3 SWS)
Bachmann A

Grundlagen der Physikalischen Chemie 1, Übung (LV0114) (Übung, 1 SWS)
Bachmann A
For further information in this module, please click campus.tum.de or here.

Module Description

CH1123: Chemical Engineering for TUM-BWL | Technische Chemie für TUM-BWL

Version of module description: Gültig ab summerterm 2018

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:
In dem Modul erfolgt die Überprüfung der Lernergebnisse über eine schriftliche Prüfung (Klausur, 120 Minuten). In dieser Prüfung sollen die Studierenden nachweisen, dass sie Reaktionskinetiken mit der Betriebsweise von Reaktoren verknüpfen und erklären können. Sie können verschiedenen Katalysen (homogen, heterogen) anhand von Beispielen aus der Produktion von Energie und Rohstoffen sowie chemischen Grundstoffen und bei der Reduktion von Emissionen beschreiben und einordnen. Die Studierenden können nachweisen, dass sie Polymere nach ihrer Herkunft und nach dem Herstellungsverfahren einordnen können. Sie können die Unterschiede zwischen idealer und realer Kinetik der radikalischen Polymerisation erklären. Sie sind in der Lage anhand vorgegebener Parameter die Produktionsleistung von verschiedenen Idealrektoren zu berechnen und können den Zusammenhang zwischen Molmasse, Molmassenverteilung und den Einfluss des Polymerisationsverfahrens auf die Molmassenverteilung wiedergeben. In der Klausur sind keine Hilfsmittel erlaubt. Es werden Aufgaben gestellt, die mittels selbst formulierter Texte beantwortet werden müssen, sowie auch Multiple Choice-Aufgaben. Darüber hinaus werden kurze Rechenaufgaben gestellt.

Repeat Examination:
End of Semester

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

Content:
Modulinhalte zur Technischen Chemie:
- Polymerisationsart (radikalisch, ionisch, koordinativ)
- Polymerisationsverfahren
- Reaktionsgeschwindigkeit

- Aggregatzustand von Monomeren und Polymeren
- Löslichkeit von Monomeren und Polymeren
- Wärmeentwicklung (Temperaturkontrolle)
- Viskosität
- Suspensions- und Emulsiaonspolamerisation
- 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.

Modulinhalte zur Reaktionstechnik und Katalyse:
Einfache und komplexe 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:
Nach der Teilnahme am Modul sind die Studierenden in der Lage, Makromoleküle nach ihrer Herkunft, nach ihrer Synthese und nach ihren Eigenschaften zu beschreiben. Die Studierenden haben grundlegende Kenntnisse über Polymerisationskinetik und Polymer-Analytik. Die Studierenden haben Grundkenntnisse über Reaktorarten, Betriebsweise von Reaktoren und Polymerisationsverfahren. Weiterhin können die Studierenden die grundlegenden Elemente einfacher und komplexer Reaktionskinetik und Katalyse auf industrielle Prozesse anwenden und deren Anwendung in Reaktoren verstehen und anwenden. Dies umfasst neben homogenen Systemen, auch Reaktion, in die als Katalysatoren involviert sind (Beschreibung und Wärmeauswirkungen des Stofftransports).

Teaching and Learning Methods:
Das Modul besteht aus zwei Vorlesungen. Die Inhalte der Vorlesungen werden im Vortrag und durch Präsentationen behandelt. Studierende sollen zum Studium der Literatur und der inhaltlichen Auseinandersetzung mit den Themen angeregt werden. Im Rahmen eingeschobener Fragestunden werden konkrete Fragestellungen beantwortet und ausgesuchte Beispiele bearbeitet.

Media:
Folien, Tafelarbeit, PowerPoint, Skript

Reading List:
- Martin Brahm (Hirzel Verlag Stuttgart)
Polymerchemie Kompakt
- Wilhelm Keim (Wiley-VCH)
Kunstoffe
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
- M. Baerns, A. Behr, A. Brehm, J. Gmehling, H. Hofmann, U. Onken, A. Renken, Technische Chemie, Wiley-VCH Verlag 2006.
- G. Emig, E. Klemm, Technische Chemie, Springer 2005; O. Levenspiel, Chemical Reaction Engineering, Wiley-Verlag, NY, 1972.
- Jens Hagen, Chemische Reaktionstechnik, Eine Einführung mit Übungen, Wiley-VCH, Weinheim, 1992.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Reaktionstechnik und Katalyse für TUM-BWL (LV0373) (Vorlesung, 2 SWS)
Lercher J, Ember E

Angewandte Technische Chemie (Makromolekulare Chemie) (LV0374) (Vorlesung, 2 SWS)
Troll C, Rieger B
For further information in this module, please click campus.tum.de or here.

Specialization in Technology: Informatics | Technik-Schwerpunkt: Informatik

Required Modules Informatics | Pflichtfächer Informatik

Module Description

IN0001: Introduction to Informatics 1 | Einführung in die Informatik 1

Version of module description: Gültig ab winterterm 2011/12

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:
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 contextfree grammers
++ 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:
Einführung in die Informatik 1 (IN0001) (Vorlesung, 4 SWS)

Seidl H, Erhard J, Hagerer G
For further information in this module, please click campus.tum.de or here.

Module Description

IN0002: Fundamentals of Programming (Exercises & Laboratory) | Praktikum: Grundlagen der Programmierung

Version of module description: Gültig ab winterterm 2011/12

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:
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 paticipants 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 excercise 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 languae 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, whitebord, software development environment

Reading List:
See modul IN0001

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

Courses (Type of course, Weekly hours per semester), Instructor:
Praktikum: Grundlagen der Programmierung (IN0002), Do (Praktikum, 4 SWS)
Seidl H [L], Erhard J, Hagerer G
For further information in this module, please click campus.tum.de or here.

Module Description

IN0006: Introduction to Software Engineering | Einführung in die Softwaretechnik

Version of module description: Gültig ab summerterm 2015

Module Level: Bachelor	**Language:** German/English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**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 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:
B. Bruegge, A. Dutoit: Object-Oriented Software Engineering: Using UML, Design Patterns and Java, 3rd Edition, Pearson Education, 2010
I. Sommerville, Software Engineering, 9th edition, Addison Wesley, 2010

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

Courses (Type of course, Weekly hours per semester), Instructor:
Übungen zu Einführung in die Softwaretechnik (IN0006) [1/4] (Übung, 2 SWS)
Krusche S [L], Bernius J, Volynsky E, Krusche S, Bhatotia P

Übungen zu Einführung in die Softwaretechnik (IN0006) [3/4] (Übung, 2 SWS)
Krusche S [L], Bernius J, Volynsky E, Krusche S, Bhatotia P

Einführung in die Softwaretechnik (IN0006) (Vorlesung, 3 SWS)
Krusche S [L], Krusche S, Bhatotia P, Bernius J, Volynsky E
For further information in this module, please click campus.tum.de or here.

Module Description

IN0008: Fundamentals of Databases | Grundlagen: Datenbanken

Version of module description: Gültig ab winterterm 2011/12

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
Credits:* 6	**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:
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:
- Alfons Kemper, André Eickler: Datenbanksysteme. Eine Einführung. 8., aktualisierte und erweiterte Auflage, Oldenbourg Verlag, 2011
- A. Kemper, M. Wimmer: Übungsbuch: Datenbanksysteme. 3. Auflage Oldenbourg Verlag, 2012
- A. Silberschatz, H. F. Korth, S. Sudarshan: Database System Concepts. Sixth Edition, McGraw-Hill, 2010

Responsible for Module:
Kemper, Alfons; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Grundlagen: Datenbanken (IN0008) (Vorlesung, 3 SWS)
Kemper A, Anneser C, Schmeißer J, Sichert M, Vogel L

Übungen zu Grundlagen: Datenbanken (IN0008) Gruppen 1-25 (Übung, 2 SWS)
Kemper A [L], Anneser C, Schmeißer J, 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 | Grundlagen: Betriebssysteme und Systemsoftware

Version of module description: Gültig ab summerterm 2012

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
Credits:* 6	**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:
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:
A.S. Tanenbaum, H. Bos: Modern Operating Systems, 4/E (Pearson, 2015)

Responsible for Module:
Baumgarten, Uwe; Prof. Dr. rer. nat. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Grundlagen: Betriebssysteme und Systemsoftware (IN0009) (Vorlesung, 3 SWS)
Ott J [L], Ott J, Uhl M

Übungen zu Grundlagen: Betriebssysteme und Systemsoftware (IN0009) (Übung, 2 SWS)
Ott J [L], Uhl M
For further information in this module, please click campus.tum.de or here.

Module Description

IN8024: Information Management for Digital Business Models | Informationsmanagement für Digitale Geschäftsmodelle

Version of module description: Gültig ab summerterm 2018

Module Level: Bachelor	**Language:** English	**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 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:
Informationsmanagement, Krcmar, Helmut, 6th ed., 2015, ISBN: 978-3-662-45862-4, Springer (primary literature)

Einführung in das Informationsmanagement, Krcmar, Helmut, 2nd ed., 2015, ISBN: 978-3-662-44328-6, Springer

Wirtschaftsinformatik: Grundlagen betrieblicher Informationssysteme, Schwarzer, Bettina, Krcmar, Helmut, 5th ed., 2014, ISBN: 978-3-791-02895-8, Schäffer-Poeschel

Responsible for Module:
Großklags, Jens; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Information Management for Digital Business Models (IN8024) (Vorlesung mit integrierten Übungen, 4 SWS)
Großklags J [L], Großklags J, Posa T
For further information in this module, please click campus.tum.de or here.

Elective Modules Informatics | Wahlfächer Informatik

Module Description

IN0003: Functional Programming and Verification | Funktionale Programmierung und Verifikation

Version of module description: Gültig ab winterterm 2018/19

Module Level: Bachelor	**Language:** German/English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**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 asignments 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:
Guy Cousineau und Michel Mauny, The Functional Approach to Programming, Cambridge University Press, Cambridge, 1998
Apt, Olderog: Programm-Verifikation. Springer 1991
Gerd Smolka: Programmierung - eine Einführung in die Informatik mit Standard ML. Oldenburg, 2007
Simon Tompson: Haskell: the Craft of Functional Programming. Addison-Wesley, 2011

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

Courses (Type of course, Weekly hours per semester), Instructor:
Funktionale Programmierung und Verifikation (IN0003) (Vorlesung, 2 SWS)
Kappelmann K, Nipkow T, Rädle J, Stevens L

Übungen zu Funktionale Programmierung und Verifikation (IN0003) (Übung, 2 SWS)
Nipkow T [L], Kappelmann K, Rädle J, Stevens L
For further information in this module, please click campus.tum.de or here.

Specialization in Technology: Electrical Engineering and Information Technology | Technik-Schwerpunkt: Elektro- und Informationstechnik

Required Modules Electrical Engineering and Information Technology | Pflichtfächer Elektro- und Informationstechnik

Module Description

EI10002: Principles of Electrotechnology | Principles of Electrotechnology [PiET]

Version of module description: Gültig ab winterterm 2017/18

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 (Vorlesung, 3 SWS)
Wittmann F

Principles in Electrotechnology (Übung, 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 | Analog Electronics [AE]

Version of module description: Gültig ab summerterm 2018

Module Level: Bachelor	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 100	**Contact Hours:** 50

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 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:
Analog Electronics (Vorlesung, 2 SWS)
Wittmann F

Analog Electronics (Exercises) (Übung, 1 SWS)
Wittmann F (Seyfert L)
For further information in this module, please click campus.tum.de or here.

Module Description

EI1289: Electrical Engineering | Elektrotechnik

Version of module description: Gültig ab summerterm 2019

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:
Die Prüfungsleistung wird in Form einer Klausur (90 min) erbracht. In dieser soll nachgewiesen werden, dass in begrenzter Zeit mit Hilfsmittel (2 handgeschriebene A4-Seiten) in den Veranstaltungen des Moduls behandelte Grundaufgaben gelöst werden können. Die Klausur besteht aus Fragen, in dem das Verständnis geprüft wird, und Aufgaben, in den z.B. eine Kurzschlussberechnung eines Transformators berechnet werden müssen. Mit den Prüfungsaufgaben wird das Erreichen der angestrebten Lernergebnisse des Moduls geprüft. Die Prüfungsfragen gehen über den gesamten Vorlesungsstoff.

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:
Nach der Teilnahme an der Modulveranstaltung ist der Studierende in der Lage, die Grundzüge der Elektrotechnik zu verstehen. Er kennt die Grundlagen der elektrischen und magnetischen Felder, ist vertraut mit Gleichstrom-, Wechselstrom- und Drehstromsystemen. Die Funktion und Beschreibung von elektrischen Maschinen wird grundsätzlich anhand von Beispielen erklärt. Die Grundlagen der Leistungselektronik sowie die wesentlichen Bauelemente wurden ihm vorgestellt.

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 Lehrmethode 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, Energietechnik
Elpers, Meyer, Skornitzke, Willner
Kieser Verlag, ISBN 3-8242-2022-9
" 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:
Elektrotechnik (LB-MT; DBP-MT; TUM BWL) (Vorlesung mit integrierten Übungen, 3 SWS)
Almomani T [L], Witzmann R, Würl T
For further information in this module, please click campus.tum.de or here.

Module Description

EI29821: Principles of Information Engineering | Grundlagen der Informationstechnik

Version of module description: Gültig ab winterterm 2017/18

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**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:
Die Prüfungsleistung wird in Form einer Klausur (75 min) erbracht. In dieser soll nachgewiesen werden, dass in begrenzter Zeit und ohne Hilfsmittel in den Veranstaltungen des Moduls behandelte Grundaufgaben der Informationstechnik gelöst werden können. Mit den Prüfungsaufgaben wird das Erreichen der angestrebten Lernergebnisse des Moduls geprüft. Die Prüfungsfragen gehen über den gesamten Vorlesungsstoff.

Repeat Examination:
Next semester

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

Content:
Klassifizierung von Signalen, Abgrenzung Datenverarbeitung - Datenübertragung. Grundlegende Elemente der Datenverarbeitung: Beschreibung von Schaltnetzen, Boolesche Algebra, Schaltfunktionen, disjunktive und konjunktive Normalform, Minimierung von Schaltfunktionen. Zahlensysteme, Rechnen im Dualsystem. Schaltwerke. Maschinenprogrammierung. Grundlegende Elemente der Datenübertragung: deterministische und stochastische Signale. Periodische Signale, reelle und komplexe Darstellung, Fourier-Reihenentwicklung. A/D und D/A-Umsetzung. Grundlage statistischer Methoden, Zufallsgrößen, Wahrscheinlichkeitsdichte, Verteilungsfunktionen und Momente. Berechnung der Bitfehlerwahrscheinlichkeit digitaler Übertragungssysteme. Einfache Codes zur Fehlerkorrektur.

Intended Learning Outcomes:
Durch die Teilnahme an den Modulveranstaltungen erhalten die Studierenden Grundkenntnisse in ausgewählten Themenbereichen der Informationstechnik. Sie haben die Fähigkeit, auf den

behandelten Themenfeldern grundlegende Aufgaben der Schaltungsentwicklung und Schaltungs- bzw. Signalanalyse durchzuführen.

Teaching and Learning Methods:
Das Modul besteht aus einer Vorlesung (2SWS) und einer Übung (2SWS). 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 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) (Vorlesung, 4 SWS)
Hanik N, Kernetzky K, Plabst D
For further information in this module, please click campus.tum.de or here.

Module Description

EI2986: Telecommunication I - Signal Representation | Nachrichtentechnik I - Signaldarstellung

Version of module description: Gültig ab winterterm 2018/19

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:
Die Prüfungsleistung wird in Form einer Klausur (75 min) erbracht. In dieser soll nachgewiesen werden, dass in begrenzter Zeit und ohne Hilfsmittel in den Veranstaltungen des Moduls behandelte Grundaufgaben der linearen Systemtheorie gelöst werden können. Mit den Prüfungsaufgaben wird das Erreichen der angestrebten Lernergebnisse des Moduls geprüft. Die Prüfungsfragen gehen über den gesamten Vorlesungsstoff.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Grundlegende Kenntnisse der Differential- und Integralrechnung.

Content:
Signale und Spektren: stochastische, periodische, aperiodische Signale. Fourierreihe, Fourierintegral und Fouriertransformation. Systemtheorie linearer zeitinvarianter Systeme: Übertragungsfunktion, Impulsantwort, lineare Verzerrungen, Faltung. Beispiele linearer Systeme: elektrische Tiefpass-Filter, kohärent-optische Fouriertransformation. Einfache nichtlineare Systeme.

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 zeitinvariante Systeme im Zeit- und Frequenzbereich zu analysieren und auftretende Störungen zu berechnen und zu bewerten.

Teaching and Learning Methods:
Das Modul besteht aus einer Vorlesung (2 SWS) und einer Übung (1 SWS) . 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 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:
Nachrichtentechnik I - Signaldarstellung (LB) (Vorlesung mit integrierten Übungen, 3 SWS)
Hanik N, Plabst D
For further information in this module, please click campus.tum.de or here.

Module Description

IN8005: Introduction into Computer Science (for non Informatics studies) | Einführung in die Informatik für andere Fachrichtungen

Version of module description: Gültig ab summerterm 2015

Module Level: Bachelor	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**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:
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.

In case of epidemiologic emergencies, the exam may be substituted by a graded electronic exercise or a proctered exam.

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
- 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:
Einführung in die Informatik für andere Fachrichtungen (TUM BWL) (IN8005) (Vorlesung, 2 SWS) Groh G

Übung zur Einführung in die Informatik für andere Fachrichtungen (TUM BWL) (IN8005) (Übung, 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 | Mathematische Behandlung der Natur- und Wirtschaftswissenschaften 2

Version of module description: Gültig ab winterterm 2021/22

Module Level: Bachelor	**Language:** English	**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 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:
J. Hainzl. Mathematik für Naturwissenschaftler. Teubner 1974.
K. Meyberg, P. Vachenauer. Höhere Mathematik 1+2. Springer 2001.
O. Opitz. Mathematik. Lehrbuch für Ökonomen. Oldenbourg 2002.
M. Precht, K. Voit, R. Kraft. Mathematik für Nichtmathematiker 1+2. Oldenbourg 1994.
K. Sydsæter, O. Hammond. Mathematik für Wirtschaftswissenschaftler. Pearson 2003.
L. Papula. Mathematik für Ingenieure und Naturwissenschaftler 1+2. Vieweg & Sohn 2001.
G. Merziger, T. Wirth. Repetitorium der höheren Mathematik. Binomi 1999.
L. Råde, B. Westergren, P. Vachenauer. Springers mathematische Formeln. Springer 2000.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Mathematische Behandlung der Natur- und Wirtschaftswissenschaften 2 [MA9714] (Vorlesung, 3 SWS)
Ritter M

Vertiefungsübungen zu Mathematische Behandlung der Natur- und Wirtschaftswissenschaften 2 [MA9714] (Übung, 2 SWS)
Ritter M

Übung zu Mathematische Behandlung der Natur- und Wirtschaftswissenschaften 2 [MA9714] (Übung, 1 SWS)
Ritter M
For further information in this module, please click campus.tum.de or here.

Elective Modules Electrical Engineering and Information Technology | Wahlfächer Elektro- und Informationstechnik

Module Description

EI0602: Audio Communication | Audiokommunikation

Version of module description: Gültig ab summerterm 2014

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 Schallwandlern, zu lösen sind und weiterführende Fragen zu Aspekten der Hörwahrnehmung beantwortet werden sollen. Studierende weisen so die Fähigkeit zu Berechnungen in der Akustik und das Verständnis der Hörwahrnehmung nach.

Repeat Examination:
Next semester

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

Content:
Komponenten der Audiokommunikation. Physik: Schallgrößen (Druck, Schnelle, Intensität, Impedanz), Schallfelder, Schallwandler (dynamische, elektrostatische Wandler, Kolbenmembran), Schallspeicher (Schallplatte, CD, MP3, SACD, DVD-Audio). Physiologie: peripheres Hörsystem, Otoakustische Emissionen (OAE), zentrales Hörsystem. Psychoakustik: Methoden, Hörfläche, Maskierung, Frequenzgruppen, Lautheit, Schärfe, Tonhöhe, Ausgeprägtheit der Tonhöhe, Unterschiedsschwellen, Schwankungsstärke, Rauigkeit, Binaurales Hören: binaurale Information, Richtungshören und binaurale Entmaskierung. Anwendungen: Auswahl aktueller Forschungsergebnisse aus Audiologie, Geräuschdesign, Raumakustik, Sprachgütebeurteilung, Tonstudiotechnik.

Intended Learning Outcomes:
Nach dem erfolgreichen Abschluss des Moduls sind die Studierenden in der Lage, die Theorie und Praxis von Schallwandlern und Schallspeichern zu verstehen und auf die Berechnung von Schallfeldern einfacher Schallstrahler anzuwenden. Die Studierenden haben ein grundlegendes Verständnis der Physiologie und Psychoakustik des Gehörs und sind in der Lage, dieses auf Fragestellungen in der Audiologie, Signalcodierung und Studiotechnik, sowie der gehörgerechten Beurteilung der akustischen Produktqualität anzuwenden.

Teaching and Learning Methods:
Die Studieninhalte werden primär in einer Vorlesung und einer Übung vermittelt. In der Übung werden Vorlesungsinhalte u.a. durch Rechenbeispiele vertieft und auf praktische Fragestellungen angewandt. Umfangreiche Hörbeispiele helfen dem Verständnis. Der Anwendungsbezug wird durch die Vorstellung von aktuellen Forschungsarbeiten der Arbeitgruppe vertieft. Die Studenten erhalten weiterhin Material zum Selbststudium in ausgewählten Themenbereichen.

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

Reading List:
Fastl, H., Zwicker, E.: Psychoacoustics - Facts and Models, 3. Auflage, Springer, Heidelberg, 2007.
Terhardt, E.: Akustische Kommunikation, Springer-Verlag, Berlin Heidelberg, 1998.
Yost, W.: Fundamentals of Hearing, An Introduction, 5. Auflage, Brill Academic Pub, 2013.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Audiokommunikation (Vorlesung mit integrierten Übungen, 3 SWS)
Seeber B, Kolotzek N
For further information in this module, please click campus.tum.de or here.

Module Description

EI0644: Photovoltaic Stand Alone Systems | Photovoltaische Inselsysteme

Version of module description: Gültig ab winterterm 2015/16

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** summer semester
Credits:* 5	**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:
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.

Als Lernmethode wird zusätzlich zu den individuellen Methoden des Studierenden eine vertiefende Wissensbildung durch anschauliche Fallstudienbetrachtungen angestrebt. Während des Semesters sollen fachliche Vertiefungen durch Lesen von Fachartikeln erfolgen. Diese zu lesenden Artikel werden in der Vorlesung diskutiert und sind auch prüfungsrelevant.

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 Enmergiewende.

Reading List:
Allgemeine Literatur wird in der Vorlesung bekannt gegeben.
Es werden verschiednene 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:
Photovoltaische Inselsysteme (Vorlesung, 3 SWS)
Jossen A, Tepe B

Photovoltaische Inselsysteme (Übung, 1 SWS)
Jossen A, Tepe B
For further information in this module, please click campus.tum.de or here.

Specialization in Technology: Mechanical Engineering | Technik-Schwerpunkt: Maschinenwesen

Required Modules Mechanical Engineering | Pflichtfächer Maschinenwesen

Module Description

BV350007: Materials in Mechanical Engineering | Werkstoffe im Maschinenwesen [Materials in mechanical engineering]

Version of module description: Gültig ab summerterm 2021

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:
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:
none

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, overheadprojector, board, experiments, video

Reading List:
- Roos, E; Maile, K.: Werkstoffkunde für Ingenieure. Springer 2005
- Reissner, J.: Werkstoffkunde für Bachelors. Hanser Verlag 2010
- 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. Th. Kränkel: mailto: thomas.kraenkel@tum.de Dr.-Ing. K. Osterminski mailto: kai.osterminski@tum.de

Courses (Type of course, Weekly hours per semester), Instructor:
Werkstoffe im Maschinenwesen (Vorlesung mit integrierten Übungen, 4 SWS)
Kränkel T, Osterminski K
For further information in this module, please click campus.tum.de or here.

Module Description

IN8005: Introduction into Computer Science (for non Informatics studies) | Einführung in die Informatik für andere Fachrichtungen

Version of module description: Gültig ab summerterm 2015

Module Level: Bachelor	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**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:
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.

In case of epidemiologic emergencies, the exam may be substituted by a graded electronic exercise or a proctered exam.

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
- 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:
Einführung in die Informatik für andere Fachrichtungen (TUM BWL) (IN8005) (Vorlesung, 2 SWS) Groh G

Übung zur Einführung in die Informatik für andere Fachrichtungen (TUM BWL) (IN8005) (Übung, 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 | Mathematische Behandlung der Natur- und Wirtschaftswissenschaften 2

Version of module description: Gültig ab winterterm 2021/22

Module Level: Bachelor	**Language:** English	**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 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:
J. Hainzl. Mathematik für Naturwissenschaftler. Teubner 1974.
K. Meyberg, P. Vachenauer. Höhere Mathematik 1+2. Springer 2001.
O. Opitz. Mathematik. Lehrbuch für Ökonomen. Oldenbourg 2002.
M. Precht, K. Voit, R. Kraft. Mathematik für Nichtmathematiker 1+2. Oldenbourg 1994.
K. Sydsæter, O. Hammond. Mathematik für Wirtschaftswissenschaftler. Pearson 2003.
L. Papula. Mathematik für Ingenieure und Naturwissenschaftler 1+2. Vieweg & Sohn 2001.
G. Merziger, T. Wirth. Repetitorium der höheren Mathematik. Binomi 1999.
L. Råde, B. Westergren, P. Vachenauer. Springers mathematische Formeln. Springer 2000.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Mathematische Behandlung der Natur- und Wirtschaftswissenschaften 2 [MA9714] (Vorlesung, 3 SWS)
Ritter M

Übung zu Mathematische Behandlung der Natur- und Wirtschaftswissenschaften 2 [MA9714] (Übung, 1 SWS)
Ritter M

Vertiefungsübungen zu Mathematische Behandlung der Natur- und Wirtschaftswissenschaften 2 [MA9714] (Übung, 2 SWS)
Ritter M
For further information in this module, please click campus.tum.de or here.

Module Description

MW1108: Engineering Mechanics for Technology Management | Technische Mechanik für TUM-BWL

Version of module description: Gültig ab winterterm 2017/18

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
Credits:* 6	**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:
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:
Technische Mechanik für TUM-BWL (Übung, 1 SWS)
Krempaszky C [L], Krempaszky C (Jahn Y)

Technische Mechanik für TUM-BWL - Vertiefungsübung (Übung, 2 SWS)
Krempaszky C [L], Krempaszky C (Jahn Y)

Technische Mechanik für TUM-BWL (Vorlesung, 2 SWS)
Krempaszky C [L], Krempaszky C (Jahn Y)
For further information in this module, please click campus.tum.de or here.

Module Description

MW1694: Machine Elements - Basics, Manufacturing, Application | Maschinenelemente - Grundlagen, Fertigung, Anwendung [ME-BMA]

Version of module description: Gültig ab winterterm 2018/19

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
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:
Die Modulprüfung findet in Form einer schriftlichen Klausur (Bearbeitungsdauer 120 Minuten) statt. Anhand von Verständnisfragen, konstruktiven Zeichnungen und Rechenaufgaben sollen die Studierenden nachweisen, dass sie Verständnis für die grundlegenden Elemente von Maschinen besitzen und dieses auch anwenden können. Sie sollen beispielsweise nachweisen, dass sie Normen anwenden, Toleranzen und Passungen entwickeln, Oberflächengüten bewerten, statische Festigkeitsberechnungen anwenden, stoffschlüssige Verbindungen, wie z. B. Schweißen, Löten, Kleben und Nieten bewerten, Schraub- und Welle-Nabe-Verbindungen entwickeln und Gestaltungsrichtlinien in der Konstruktion anwenden können. Weiterhin kann überprüft werden, ob Paarungen und Lager analysiert und Getriebe verstanden werden können. Schmierungen und Dichtungen sollen erinnert werden.
Als Hilfsmittel zur Prüfung wird eine vom Lehrstuhl erstellte Formelsammlung ausgegeben. Des Weiteren sind nicht programmierbare Taschenrechner zugelassen.

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 Studieren-den in der Lage grundlegende Zusammenhänge von Maschinenelemen-ten 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 Vorlesung werden die theoretischen Grundlagen zu Maschinene-lementen mittels Vortrag und Präsentation vermittelt. Den Studierenden wird dazu ein Skript zur Verfügung gestellt, in dem sie die Theorie durch eigene Notizen ergänzen können. Mit den Erläuterungen aus der Vorle-sung und entsprechendem Eigenstudium lernen die Studierenden, Nor-men anzuwenden, Toleranzen und Passungen zu entwickeln, Oberflä-chengüten zu bewerten, statische Festigkeitsberechnungen anzuwen-den, stoffschlüssige Verbindungen, wie z.B. Schweißen, Löten, Kleben und Nieten zu bewerten, Schraub- und Welle-Nabe-Verbindungen zu entwickeln und Gestaltungsrichtlinien in der Konstruktion anzuwenden. Paarungen und Lager sollen analysiert und Getriebe verstanden werden können. Schmierungen und Dichtungen sollen erinnert werden.
In der Übung werden Beispielaufgaben gemeinsam mit den Studieren-den 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:
Niemann, Gustav; Höhn, Bernd-Robert; Winter, Hans (2005): Maschinenelemente. Entwerfen, Berechnen und Gestalten im Maschinenbau ; ein Lehr- und Arbeitsbuch. 4., bearb. Berlin [u.a.]: Springer.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Maschinenelemente - Grundlagen, Fertigung, Anwendung Übung (MW1694) (Übung, 3 SWS)
Zäh M, Busch M

Maschinenelemente - Grundlagen, Fertigung, Anwendung (MW1694) (Vorlesung, 2 SWS)
Zäh M, Busch M, Sigl M, Zhao X
For further information in this module, please click campus.tum.de or here.

Module Description

MW2385: CAD and Machines Drawing (Specialization/Application Area) | CAD und Maschinenzeichnen (Spezialisierung/Anwendungsfach) [CADundMZ]

Version of module description: Gültig ab winterterm 2018/19

Module Level: Bachelor	**Language:** German	**Duration:** two semesters	**Frequency:** winter/summer semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 45	**Contact Hours:** 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 Maschinenzeichnen 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.
In der Klausur wird geprüft, inwieweit die Studierenden in der Lage sind eigene technische Zeichnungen anzufertigen, moderne CAD-Systeme und deren Modellierungsansätze softwareunabhängig zu beherrschen und Fragestellungen hinsichtlich einer sinnvollen Gestaltung von Konstruktionen anhand von Beispielen zu beantworten. Neben dem üblichen Schreibmaterial sind in der Prüfung Zeichenstifte, Bleistifte, Zirkel, Lineale und die Kreisschablone als Hilfsmittel zugelassen. Durch die schriftliche Klausurform wird eine praxisnahe Prüfung der erlernten Fähigkeiten sichergestellt. Die Prüfungsnote gilt als Modulnote.
Die Übungsleistung beinhaltet die Bearbeitung von vorgegebenen Aufgaben, die sich über das Winter- und das Sommersemester erstrecken, aus den Komponenten CAD-Einführung sowie Skizzier- und Darstellungstechniken.
Die Möglichkeit die Aufgaben aus "CAD-Einführung" zu bearbeiten, wird regulär im Wintersemester angeboten. Die Studierenden sollen zeigen, dass sie in der Lage sind CAD-Konstruktionen und technische Zeichnungen zu erstellen. Diese Aufgaben werden in Heimarbeit bearbeitet, wobei Bauteile und Baugruppen in CAD modelliert werden sollen. An Präsenzterminen werden dazu in einem Umfang von vier Testaten (je circa 15-20 min) die Modellierungen überprüft. Die Bewertung der Bauteile und Testate erfolgt durch CAD-erfahrene Mitarbeiter des Lehrstuhls.
Die Möglichkeit die Aufgaben zu "Skizzier- und Darstellungstechniken" zu bearbeiten, erfolgt im Sommersemester. Dazu erstellen die Studierenden technische Zeichnungen von Maschinenbauteilen. Die Überprüfung der Zeichnungen erfolgt nach einem auf der moodle-Plattform zugänglichen Kriterienkatalog, erstellt durch Mitarbeiter des Lehrstuhls.

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 Technisches Zeichnens. Folgende Lehrinhalte werden vermittelt:
- Grundlagen der Zeichnungserstellung
- Darstellung eines Bauteils
- Bemaßung von Bauteilen
- Oberflächen-, Kanten- und Härteangaben
- Toleranzen und Passungen
- Fügeverbindungen, Schmieden, Gießen
- Normteile
- Freihandzeichnen

Im Praktikum "CAD-Einführung" im WS werden die Grundlagen der Arbeit mit CAD-Systemen gelehrt. Neben der Erstellung von Bauteilen, Baugruppen und Zeichnungen im 3D und 2D Bereich wird sukzessive das Wissen aus der Vorlesung vertieft. Der Schwerpunkt des zweiten Teils von CAD und Maschinenzeichnen liegt in der Vorlesung "Konstruktive Gestaltungslehre" im SS. Diese Vorlesung vermittelt prinzipielle Gestaltungsregeln bei der Konstruktion von Bauteilen. Dazu werden neben den Grundregeln der Gestaltungslehre, fertigungsspezifische Gestaltungsregeln sowie Hinweise zur Montage- und belastungsgerechten Gestaltung gegeben.

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
- Übungsblätter
- Lehrvideos
- e-Learning
- Aufgaben und Lösungen

Reading List:
- Skripten des Lehrstuhls fml
- Unterlagen auf moodle-Plattform
- Hoischen, H.; Fritz, A.: Technisches Zeichnen; Berlin, Cornelsen 2018, 36. Auflage; ISBN: 978-3-06-451712-7

Responsible for Module:
Fottner, Johannes; Prof. Dr.-Ing.

Courses (Type of course, Weekly hours per semester), Instructor:
CAD und Maschinenzeichnen 1 - VL - Regeln des technischen Zeichnens (CAMPP) (Vorlesung, 1 SWS)
Fottner J (Dahlenburg M, Kessler S, Pfeiffer M, Rief J, Rücker A, Tan Y)

CAD und Maschinenzeichnen 1 - ZÜ - Regeln des technischen Zeichnens (CAMPP) (Übung, 1 SWS)
Fottner J (Dahlenburg M, Pfeiffer M, Rief J, Rücker A, Tan Y)

CAD und Maschinenzeichnen 2 - Praktikum Skizzer- und Darstellungstechniken (Praktikum, 2 SWS)
Fottner J (Kessler S, Kleeberger M, Mitarbeiter W, Pfeiffer M, Rücker A, Tan Y)

CAD und Maschinenzeichnen 2 - Vorlesung (Vorlesung, 1 SWS)

Fottner J (Kessler S, Pfeiffer M, Rücker A)

CAD und Maschinenzeichnen 2 - Zentralübung (Übung, 1 SWS)
Fottner J (Pfeiffer M, Rücker A, Tan Y)

CAD und Maschinenzeichnen 1 - Praktikum CAD-Einführung Inventor (CAMPP) (Praktikum, 1 SWS)
Rücker A [L], Fottner J (Dahlenburg M, Pfeiffer M, Rief J, Tan Y)
For further information in this module, please click campus.tum.de or here.

Elective Modules Mechanical Engineering | Wahlfächer Maschinenwesen

Module Description

MW1903: Bioprocess Engineering | Bioverfahrenstechnik

Version of module description: Gültig ab summerterm 2013

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 (Bearbeitungsdauer 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:
In diesem Modul werden die physikalischen, chemischen, biochemischen, biologischen und thermodynamischen Grundlagen biologischer Stoffumwandlungen für Ingenieure vermittelt.
1. Einführung und Grundlegendes über die Bioverfahrenstechnik, 2. physikochemische Eigenschaften des Wassers, 3. Biophysikalische Eigenschaften von Zellen, 4: Biochemische Reaktionssysteme, 5. Bioreaktionstechnik I – Enzymkinetik, 6. Bioreaktionstechnik II – Metabolische Modelle, 7. Bioreaktionstechnik III – Wachstumskinetik, 8. Steril-Verfahrenstechnik, 9. Aufarbeitung von Bioprodukten, 10. Bioprozessanalytik, 11. Industrielle Biotechnologie

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 Übungsaufgaben vorgerechnet 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.

Zur Verfügung gestellt werden Powerpoint-Folien (via Beamer) als Vorlesungs- und Übungsunterlagen und Musterlösungen zu den Übungsaufgaben.

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:
Es ist kein Lehrbuch zu allen Inhalten dieses Moduls verfügbar. Als Einführung empfiehlt sich:
Horst Chmiehl: Bioprozesstechnik. Elsevier GmbH, München.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Bioverfahrenstechnik (MW1903) (Vorlesung, 3 SWS)
Weuster-Botz D [L], Weuster-Botz D, Benner P
For further information in this module, please click campus.tum.de or here.

Module Description

MW2156: Metal-cutting Manufacturing Processes | Spanende Fertigungsverfahren

Version of module description: Gültig ab winterterm 2012/13

Module Level: Bachelor/Master	**Language:** German	**Duration:** one semester	**Frequency:** summer semester
Credits:* 5	**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:
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 bestimmter 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 Vorlesungsinhalte werden im Rahmen einer Übung vertieft. Wesentliche Inhalte der Übung sind die Berechnung von Schnittkräften zur Auslegung von Maschinen und Prozessen sowie die Erstellung von Arbeitsplänen für die spanende Fertigung.

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:
Zur Vorlesung exisitiert ein umfangreiches Skript, das durch eine Präsentation unterstützt wird. Die Vorlesungsinhalte werden zudem anhand von zahlreichen Videos und Exponaten veranschaulicht.
Sämtliche Übungsunterlagen (inklusive der Musterlösung) werden den Studierenden zum Download angeboten.

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:
Spanende Fertigungsverfahren Übung (Übung, 1 SWS)
Zäh M, Fuchs C

Spanende Fertigungsverfahren (Vorlesung, 2 SWS)

Zäh M, Wimmer M
For further information in this module, please click campus.tum.de or here.

Specialization in Technology: Computer Engineering | Technik-Schwerpunkt: Computer Engineering

Module Description

EI10001: Principles of Information Engineering | Principles of Information Engineering [PIE]

Version of module description: Gültig ab summerterm 2020

Module Level: Bachelor	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**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 asses the students' knowledge about the technical systems, e.g. information transmission systems, and their theoretical background, e.g. design priciples, 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:
Principles of Information Engineering (Vorlesung mit integrierten Übungen, 3 SWS)
Jedda H, Utschick W
For further information in this module, please click campus.tum.de or here.

Module Description

EI10002: Principles of Electrotechnology | Principles of Electrotechnology [PiET]

Version of module description: Gültig ab winterterm 2017/18

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 (Vorlesung, 3 SWS)
Wittmann F

Principles in Electrotechnology (Übung, 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 | Analog Electronics [AE]

Version of module description: Gültig ab summerterm 2018

Module Level: Bachelor	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 100	**Contact Hours:** 50

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 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:
Analog Electronics (Vorlesung, 2 SWS)
Wittmann F

Analog Electronics (Exercises) (Übung, 1 SWS)
Wittmann F (Seyfert L)
For further information in this module, please click campus.tum.de or here.

Module Description

IN2113: Programming Languages | Programmiersprachen

Version of module description: Gültig ab winterterm 2011/12

Module Level: Bachelor/Master	**Language:** German/English	**Duration:** one semester	**Frequency:** irregularly
Credits:* 5	**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 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 progamming 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:

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

Module Description

IN2161: Networks for Monetary Transactions | Netzwerke für den Zahlungsverkehr

Version of module description: Gültig ab winterterm 2011/12

Module Level: Bachelor/Master	**Language:** English	**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:
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, Hanserverlag 2002 Pohlmann "Digitale Signatur für optimale Sicherheit", Hüthigverlag 1997 ZKA, Elektronisch cash im Umfeld von SEPA, 2006

Responsible for Module:
Baumgarten, Uwe; Prof. Dr. rer. nat. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Netzwerke für den Zahlungsverkehr (IN2161) (Vorlesung, 2 SWS)
Sterzinger H, Baumgarten U
For further information in this module, please click campus.tum.de or here.

Specialization in Technology: Medical Science | Technik-Schwerpunkt: Medizin

Module Description

MEDWI001: Chemistry - Basic knowledge with clinical links | Chemie - Basiswissen mit klinischen Verknüpfungen

Version of module description: Gültig ab summerterm 2019

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:
In diesem Modul werden die Grundlagen der Chemie mit Hilfe von Text-, Video- und Audioelementen sowie Übungen erarbeitet. Ergänzend dazu zeigen klinische Exkurse die Relevanz der Chemie für die Medizin auf. Ziel des Moduls ist ein chemisches Grundlagenwissen zu erwerben, welches in anderen medizinischen Fächern wie Biochemie, Pharmakologie und klinische CHemie angewendet werden kann.
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 sind 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@lmu.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 | Biologie für Nebenfächer, 1. Teil

Version of module description: Gültig ab winterterm 2020/21

Module Level: Bachelor	**Language:** German	**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:
Aufgrund des Pandemiegeschehens hat der/die Studierende auch die Möglichkeit, an einer beaufsichtigen schriftlichen Fernprüfung mit Papier und Stift (Aufsicht mit Zoom, 90 min.) teilzunehmen (Onlineprüfung: WZ8057o). Diese Prüfung wird zeitgleich in Präsenz angeboten (WZ8057).

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 Tierstämme

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:
Purves WK, Sadava DE, Markl J (2011) Biologie. Spektrum Akademischer Verlag, Heidelberg

Responsible for Module:
Prof. Dr. Johannes Kollmann jkollmann@wzw.tum.de

Courses (Type of course, Weekly hours per semester), Instructor:
Biologie für Nebenfächler, 1. Teil (Vorlesung, 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 | Körperstrukturen und -funktionen

Version of module description: Gültig ab winterterm 2017/18

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.

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 bi ochemical 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:
Schünke M, Schulte E, Schumacher U: Prometheus – Allgemeine Anatomie und Bewegungssystem. Thieme, Stuttgart 2007;
Platzer W: Taschenatlas der Anatomie. Thieme, Stuttgart 2011; Auflage: 11. aktualisierte Auflage.
Mougios, V: Exercise Biochemistry (Englisch), 2006
Tiidus, P, Tupling, R, & Houston, M: Biochemistry Primer for Exercise Science (Englisch), 2012
Horn E: Biochemie des Menschen. Thieme, Stuttgart 2012
Königshoff M, Brandenburger T: Kurzlehrbuch Biochemie. Thieme, Stuttgart 2012
Ergänzende aktuelle Primärliteratur

Responsible for Module:
Schulz, Thorsten; Dr. Sportwiss.

Courses (Type of course, Weekly hours per semester), Instructor:
Funktionelle Anatomie des Bewegungsapparates (Vorlesung, 2 SWS)
Peters C, Schulz T

Festigung und Vertiefung funktioneller Strukturen des Bewegungsapparates (Moodlekurs) (Übung, 1 SWS)
Peters C, Schulz T

Biochemische Grundlagen des Stoffwechsels (Vorlesung, 2 SWS)
Schönfelder M

Vertiefung biochemischer Schwerpunktthemen (Moodlekurs) (Übung, 1 SWS)
Schönfelder M
For further information in this module, please click campus.tum.de or here.

Module Description

SG120025: Human Biology | Anatomie und Physiologie der inneren Organe

Version of module description: Gültig ab winterterm 2017/18

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

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 (Übung) (Übung, 1 SWS)
Goeder D, Köllner N, Peters C, Stratmann C

Anatomie und Physiologie der inneren Organe (Vorlesung) (Vorlesung, 4 SWS)
Oberhoffer-Fritz R, Peters C, Schulz T

Lernen am anatomischen Präparat (Seminar, 1 SWS)
Oberhoffer-Fritz R, Peters C, Schulz T, Weberruß H
For further information in this module, please click campus.tum.de or here.

Module Description

MEDWI002: Medical terminology | Medizinische Terminologie

Version of module description: Gültig ab summerterm 2019

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

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

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

(Recommended) Prerequisites:
Keine. Die Veranstaltung richtet sich insbesondere auch an Studierende ohne Vorkenntnisse in Latein und/oder griechisch oder medizinischer Terminologie

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

Teaching and Learning Methods:
Das Modul besteht aus Vorlesungen und Übungen.
In den Vorlesungen wird den Studierenden die medizinische Terminologie präsentiert. In den dazugehörigen Übungen haben die Studierenden die Gelegenheit Fragen zu diskutieren.

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 | Medizinische Vertiefung

Version of module description: Gültig ab summerterm 2019

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.

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

(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
- Herzinsuffizienz 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 Fachtermini 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 Fragestundenvor 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 | Medizin und Praxis

Version of module description: Gültig ab summerterm 2019

Module Level: Bachelor	**Language:** German	**Duration:** two semesters	**Frequency:** winter/summer semester
Credits:* 4	**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 Orgnaisation 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:
Das Modul besteht aus Praktika, Vorlesung und Übungen. Insbesondere in den Vorlesungen werden Inhalte präsentiert und demonstriert. In einem Praktikum der Notfallmedizin wenden die Studierenden ihr Wissen eigenständig an. Darüber erlangen die Studierenden im Laufe eines weiteren Praktikums Einblicke in die Praxis des ärztlichen Handelns im Alltag.

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) | Einführung in die Informatik für andere Fachrichtungen

Version of module description: Gültig ab summerterm 2015

Module Level: Bachelor	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**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:
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.

In case of epidemiologic emergencies, the exam may be substituted by a graded electronic exercise or a proctered exam.

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
- 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:
Einführung in die Informatik für andere Fachrichtungen (TUM BWL) (IN8005) (Vorlesung, 2 SWS) Groh G

Übung zur Einführung in die Informatik für andere Fachrichtungen (TUM BWL) (IN8005) (Übung, 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 | Projektstudium

Module Description

WI000684: Project Studies | Projektstudium

Version of module description: Gültig ab winterterm 2012/13

Module Level: Bachelor	**Language:** German/English	**Duration:**	**Frequency:** winter/summer semester
Credits:* 12	**Total Hours:** 360	**Self-study Hours:** 360	**Contact Hours:**

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 knowlege 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 evolvment 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:
Rowe, S. (2015). Project Management for Small Projects, 2nd Edition. Oakland: Berrett-Koehler Publishers.
Relevant literature will be selected and communicated specifically for the project.

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.

Electives in Management and/or Technology | Wirtschaftswissenschaftlich-technische Wahlmodule

Chemistry | Chemie

Module Description

CH0575: General and Inorganic Chemistry | Allgemeine und Anorganische Chemie

Version of module description: Gültig ab summerterm 2018

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:
Die Prüfungsleistung wird schriftlich in Form einer 90-minütigen Klausur erbracht. In dieser soll nachgewiesen werden, dass in begrenzter Zeit und ohne Hilfsmittel die grundlegenden Prinzipien der Allgemeinen und Anorganischen Chemie wiedergegeben und angewandt werden können. Die Bearbeitung der Klausur erfordert vorrangig eigenständig formulierte Antworten und Berechnungen. Dabei sollen sie z.B. Atombau und Struktur von kovalenten, ionischen und metallischen Verbindungen demonstriert erklären. Ferner sollen die Studierenden grundlegende Fragestellungen zu großtechnischen Prozessen zur Synthese von anorganischen Grundchemikalien beantworten und relevante Reaktionsgleichungen aufschreiben.

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:
Nach der erfolgreichen Teilnahme am Modul "Allgemeine und Anorganische Chemie" verstehen die Studierenden die wesentlichen Konzepte der allgemeinen und anorganischen Chemie und können sie auf einfache Beispiele selbständig anwenden. Die Studierenden verstehen den Aufbau des Periodensystems der Elemente und kennen das Vorkommen und die Herstellung der wichtigsten Hauptgruppenelemente. Sie können Konzepte wie das Massenwirkungsgesetz, die Theorie der chemischen Bindung, Oxidation und Reduktion, die Reaktion von Säuren und Basen, die MO-Theorie etc. auf typische Beispiele anwenden und die Resultate analysieren. Sie kennen wichtige großtechnische Prozesse von anorganischen Grundchemikalien. Die Studierenden erinnern sich nach der Teilnahme an dem Modul auf Grund der vorgeführten Experimente an das chemische Verhalten der jeweiligen Elemente und deren Verbindungen.

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 und ausgesuchte Beispiele bearbeitet. Die zur Bearbeitung der Aufgaben notwendige Zeit wird dabei an die Erklärungsbedürfnisse der Studierenden angepasst. In die Vorlesung eingebundene Videos helfen ein besseres Verständnis bestimmter Konzepte und Versuchsabläufe zu erlangen. Experimentalvorführungen veranschaulichen die theoretisch besprochenen Inhalte und die Reaktivität der behandelten Stoffklassen und Elemente. Die Studierenden erhalten durch sie einen ersten Einblick in das experimentelle Arbeiten in einem chemischen Labor.
Zu den Lehreinheiten werden kapitelweise Übungsblätter und zeitversetzt die dazugehörigen Musterlösungen zur Verfügung gestellt. Dadurch setzen sich die Studierenden sowohl mit der eigenen Lösungsfindung, als auch mit den Musterlösungen auseinander und werden so auf die Prüfungsklausur vorbereitet.

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

Reading List:
- Riedel/Janiak Anorganische Chemie 9. Auflage 2015 (de Gruyter);
- M. Binnewies, Jäckel, H., Willner,G.,Rayner-Canham, M.,Allgemeine und Anorganische Chemie, Spektrum Akadem. Verlag;
- C. E. Mortimer, Das Basiswissen der Chemie, Georg Thieme Verlag Stuttgart New York.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Allgemeine und Anorganische Chemie (LV0166) (Vorlesung, 4 SWS)
Köhler K
For further information in this module, please click campus.tum.de or here.

Computer Engineering | Computer Engineering

Module Description

EI10001: Principles of Information Engineering | Principles of Information Engineering [PIE]

Version of module description: Gültig ab summerterm 2020

Module Level: Bachelor	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**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 asses the students' knowledge about the technical systems, e.g. information transmission systems, and their theoretical background, e.g. design priciples, 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:
Principles of Information Engineering (Vorlesung mit integrierten Übungen, 3 SWS)
Jedda H, Utschick W
For further information in this module, please click campus.tum.de or here.

Innovation and Entrepreneurship | Innovation and Entrepreneurship

Module Description

WI000026: Advanced Technology and Innovation Management | Advanced Technology and Innovation Management

Version of module description: Gültig ab summerterm 2021

Module Level: Bachelor/Master	**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:
The grade results from a two-hour closed book exam. During the exam students l 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

Note for exchange students: For students with an economic background this subject counts as a bachelor level course. For students with a natural science background, this subject counts as a master level course.

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:
Afuah, A., & Afuah, A. (2003). Innovation management: strategies, implementation and profits.
Dodgson, M., Gann, D. M., & Salter, A. (2008). The management of technological innovation: strategy and practice. Oxford University Press on Demand.
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) (Vorlesung, 4 SWS)
Förster S, Samei A, Windisch G
For further information in this module, please click campus.tum.de or here.

Module Description

WI000285: Innovative Entrepreneurs - Leadership of High-Tech Companies | Innovative Unternehmer - Führung von High-Tech Unternehmen

Version of module description: Gültig ab summerterm 2021

Module Level: Bachelor	**Language:** English	**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 grading is based on project work. Participants choose an individual challenge running over several weeks during the semester. Each student has to write a reflection paper (max. 1500 words) on their experiences during the project work.

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.

Intended Learning Outcomes:
Upon successful completion of this module, participants will be able
Upon successful completion of this module, participants will be able to...
- understand the entrepreneurial mindset
- recognize and develop personal strengths
- develop and implement personal ideas
- 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:
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.

Moreover, in context of a 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

- Online discussion forum (e.g., for questions and feedback on guest lectures)
- Handouts (distributed online)

Reading List:
Read, S., S arasvathy, S., Dew, N., Wiltbank, R., & Ohlsson, A. V. (2016). Effectual Entrepreneurship. Taylor & Francis

Responsible for Module:
Schönenberger, Helmut; Dr. rer. pol.

Courses (Type of course, Weekly hours per semester), Instructor:
Innovative Unternehmer - Führung von High-Tech Unternehmen (Vorlesung, 2 SWS)
Schönenberger H [L], Schönenberger H
For further information in this module, please click campus.tum.de or here.

Marketing, Strategy and Leadership | Marketing, Strategy and Leadership

Module Description

MGT000996: High Performance Leadership | High Performance Leadership

Version of module description: Gültig ab winterterm 2021/22

Module Level: Master	**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:
Die Prüfungsleistung erfolgt auf Basis einer schriftlichen Klausur. Diese dauert 90 Minuten und besteht aus einer Reihe von offenen und geschlossenen bzw. multiple choice Fragen. Die Klausurfragen beziehen sich auf die Bedingungen, Inhalte und Wirkungen erfolgreichen Talent- und Veränderungsmanagements in Unternehmen sowie Zusammenhänge der Zielsetzungstheorie und aktuelle Erkenntnisse der Führungsforschung. Die geschlossenen Fragen zielen auf die Reproduktion des theoretischen Wissens der Studierenden. Die offenen Fragen zielen auf die Anwendung des Gelernten auf konkrete Problemstellungen und praxisnahe Herausforderungen. Dabei sollen die Studierenden die Zusammenhänge in eigenen Worten beschreiben und anwenden können.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
keine

Content:
Die Teilnehmer lernen, wie sie als zukünftige Führungskräfte ihre Mitarbeiter, Teams und auch sich selbst zu Bestleistungen führen können. Der Schwerpunkt der Veranstaltung liegt auf folgenden Themen:
-Die Rolle von Führungskräften im Talentmanagement (der Schwerpunkt liegt dabei auf Methoden der Identifikation Entwicklung von Talenten)

-Effektive Zielerreichung (der Schwerpunkt liegt auf dem Setzen anspruchsvoller Ziele, der Förderung der Zielbindung und Strategien für erfolgreiche Zielerreichung)
-Die Rolle von Führungskräften im Veränderungsmanagement (der Schwerpunkt liegt auf Methoden effizienter Mitarbeiterführung während organisationaler Veränderungen)

Intended Learning Outcomes:
Nach der erfolgreichen Teilnahme an dem Modul sind die Studierenden in der Lage:

- die Grundprinzipien erfolgreichen Talentmanagements zu benennen und zu erkennen, welche Rolle Führungskräfte dabei spielen.
- die Grundprinzipien von Zielvereinbarungen und entsprechende Methoden zur Zielsetzung und -erreichung wiederzugeben.
- die Grundprinzipien des Veränderungsmanagements zu erläutern und identifizieren zu können, welche Rolle Führungskräfte dabei spielen.
- Mit Blick auf die oben genannten Schwerpunkte können die Studierenden Stärken und Schwächen verschiedener Theorien und Ansätze zu beschreiben und zu gewichten. Die Ansätze können untereinander verknüpft und konkreten Problemstellungen in der Praxis zugeordnet werden, was die Beurteilung und Ausarbeitung konkreter Lösungsansätze ermöglicht.

Teaching and Learning Methods:
Das Modul ist eine Vorlesung, die jedoch interaktive Elemente beinhaltet. Das Vorlesungsformat eignet sich in besonderem Maße für die Vermittlung theoretischen Wissens. Neben dem theoretischen Input von Seiten des Lehrveranstaltungsleiters werden einzelne Themengebiete in Plenumsdiskussionen und Gruppenarbeit vertieft.

Media:
Übungsblätter, Flipchart, PowerPoint

Reading List:
Alexander Groth: Führungsstark in alle Richtungen (Auszüge), Alexander Groth: Führungsstark im Wandel (Auszüge)

Responsible for Module:
Peus, Claudia; Prof. Dr. phil.

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

For further information in this module, please click campus.tum.de

Module Description

WI001192: Evidence Based Decisions Using Big Data Analytics | Evidenzbasierte Entscheidungen auf der Grundlage von Big Data Analytics [EEBDA]

Version of module description: Gültig ab winterterm 2020/21

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter/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:
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:
Evidenzbasierte Entscheidungen auf der Grundlage von Big Data Analytics (WI001192) (Vorlesung, 4 SWS)
Ernstberger J [L], Bell N, Ernstberger J
For further information in this module, please click campus.tum.de or here.

Operations and Supply Chain Management | Operations and Supply Chain Management

Module Description

WI000264: Project Management | Project Management [PM]

Version of module description: Gültig ab summerterm 2021

Module Level: Bachelor	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 6	**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:
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:
Mathematics I and II, Management Science, Statistics, Financial Management

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 quantiative 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) (Übung, 2 SWS)
Godbersen G, Kolisch R

Project Management (WI000264) (Vorlesung, 2 SWS)
Kolisch R
For further information in this module, please click campus.tum.de or here.

Module Description

WI000978: Transportation Logistics | Transportation Logistics

Version of module description: Gültig ab summerterm 2021

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:
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 mixedinteger 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:
Toth, P., & Vigo, D. (Eds.). (2014). Vehicle routing: problems, methods, and applications (Vol. 18). Siam.
Ghiani, G., Laporte, G., & Musmanno, R. (2013). Introduction to logistics systems management. John Wiley & Sons.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Transportation Logistics (WI000978) (Vorlesung mit integrierten Übungen, 4 SWS)
Minner S [L], Malicki S, Martin L, Minner S
For further information in this module, please click campus.tum.de or here.

Finance and Accounting | Finance and Accounting

Module Description

WI000091: Corporate Finance | Corporate Finance

Version of module description: Gültig ab summerterm 2021

Module Level: Bachelor	**Language:** English	**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:
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:
• Berk, DeMarzo (2014, 3/E): Corporate Finance
• Copeland, T. E./ Weston, J. F./ Shastri, K. (2005): Financial Theory and Corporate Policy, USA, Addison Wesley, 4th International Edition.

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:
Corporate Finance (WI000091) (Vorlesung, 2 SWS)
Kaserer C (Knauer L)

Corporate Finance (WI000091): Übung (Übung, 2 SWS)
Kaserer C (Knauer L)
For further information in this module, please click campus.tum.de or here.

Module Description

WI001083: Controlling | Controlling

Version of module description: Gültig ab summerterm 2017

Module Level:	Language:	Duration:	Frequency:
Bachelor	German	one semester	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:
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. Futhermore, they apply instruments to solve examplary 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:
Küpper, H.-U. und Friedl, G. und Hofmann, C. und Hofmann, Y. und Pedell, B.: Controlling: Konzeption, Aufgaben, Instrumente, 6. Auflage, Stuttgart 2012.

Ewert, R. und Wagenhofer, A. (2008): Interne Unternehmensrechnung, 7. Auflage, Berlin u.a. 2008.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Controlling (WI001083) (Vorlesung, 2 SWS)
Friedl G [L], Friedl G, Gamarra Y

Controlling - Übung (WI001083) (Übung, 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 | Gesellschaftsrecht 2

Version of module description: Gültig ab winterterm 2018/19

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:
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:
Gesellschaftsrecht 2 (WI001108) (Vorlesung, 2 SWS)
Maume P
For further information in this module, please click campus.tum.de or here.

Informatics | Informatik

Module Description

IN0001: Introduction to Informatics 1 | Einführung in die Informatik 1

Version of module description: Gültig ab winterterm 2011/12

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:
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 contextfree grammers
++ 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:
Einführung in die Informatik 1 (IN0001) (Vorlesung, 4 SWS)
Seidl H, Erhard J, Hagerer G
For further information in this module, please click campus.tum.de or here.

Electrical Engineering and Information Technology | Elektro- und Informationstechnik

Module Description

EI0644: Photovoltaic Stand Alone Systems | Photovoltaische Inselsysteme

Version of module description: Gültig ab winterterm 2015/16

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** summer semester
Credits:* 5	**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:
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.

Als Lernmethode wird zusätzlich zu den individuellen Methoden des Studierenden eine vertiefende Wissensbildung durch anschauliche Fallstudienbetrachtungen angestrebt. Während des Semesters sollen fachliche Vertiefungen durch Lesen von Fachartikeln erfolgen. Diese zu lesenden Artikel werden in der Vorlesung diskutiert und sind auch prüfungsrelevant.

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 Enmergiewende.

Reading List:
Allgemeine Literatur wird in der Vorlesung bekannt gegeben.
Es werden verschiednene 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:
Photovoltaische Inselsysteme (Übung, 1 SWS)
Jossen A, Tepe B

Photovoltaische Inselsysteme (Vorlesung, 3 SWS)
Jossen A, Tepe B
For further information in this module, please click campus.tum.de or here.

Module Description

EI10002: Principles of Electrotechnology | Principles of Electrotechnology [PiET]

Version of module description: Gültig ab winterterm 2017/18

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 (Vorlesung, 3 SWS)
Wittmann F

Principles in Electrotechnology (Übung, 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 | Analog Electronics [AE]

Version of module description: Gültig ab summerterm 2018

Module Level: Bachelor	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 100	**Contact Hours:** 50

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 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:
Analog Electronics (Vorlesung, 2 SWS)
Wittmann F

Analog Electronics (Exercises) (Übung, 1 SWS)
Wittmann F (Seyfert L)
For further information in this module, please click campus.tum.de or here.

Mechanical Engineering | Maschinenwesen

Module Description

MW1694: Machine Elements - Basics, Manufacturing, Application | Maschinenelemente - Grundlagen, Fertigung, Anwendung [ME-BMA]

Version of module description: Gültig ab winterterm 2018/19

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
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:
Die Modulprüfung findet in Form einer schriftlichen Klausur (Bearbeitungsdauer 120 Minuten) statt. Anhand von Verständnisfragen, konstruktiven Zeichnungen und Rechenaufgaben sollen die Studierenden nachweisen, dass sie Verständnis für die grundlegenden Elemente von Maschinen besitzen und dieses auch anwenden können. Sie sollen beispielsweise nachweisen, dass sie Normen anwenden, Toleranzen und Passungen entwickeln, Oberflächengüten bewerten, statische Festigkeitsberechnungen anwenden, stoffschlüssige Verbindungen, wie z. B. Schweißen, Löten, Kleben und Nieten bewerten, Schraub- und Welle-Nabe-Verbindungen entwickeln und Gestaltungsrichtlinien in der Konstruktion anwenden können. Weiterhin kann überprüft werden, ob Paarungen und Lager analysiert und Getriebe verstanden werden können. Schmierungen und Dichtungen sollen erinnert werden.
Als Hilfsmittel zur Prüfung wird eine vom Lehrstuhl erstellte Formelsammlung ausgegeben. Des Weiteren sind nicht programmierbare Taschenrechner zugelassen.

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 Studieren-den in der Lage grundlegende Zusammenhänge von Maschinenelemen-ten 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 Vorlesung werden die theoretischen Grundlagen zu Maschinene-lementen mittels Vortrag und Präsentation vermittelt. Den Studierenden wird dazu ein Skript zur Verfügung gestellt, in dem sie die Theorie durch eigene Notizen ergänzen können. Mit den Erläuterungen aus der Vorle-sung und entsprechendem Eigenstudium lernen die Studierenden, Nor-men anzuwenden, Toleranzen und Passungen zu entwickeln, Oberflä-chengüten zu bewerten, statische Festigkeitsberechnungen anzuwen-den, stoffschlüssige Verbindungen, wie z.B. Schweißen, Löten, Kleben und Nieten zu bewerten, Schraub- und Welle-Nabe-Verbindungen zu entwickeln und Gestaltungsrichtlinien in der Konstruktion anzuwenden. Paarungen und Lager sollen analysiert und Getriebe verstanden werden können. Schmierungen und Dichtungen sollen erinnert werden.
In der Übung werden Beispielaufgaben gemeinsam mit den Studieren-den 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:
Niemann, Gustav; Höhn, Bernd-Robert; Winter, Hans (2005): Maschinenelemente. Entwerfen, Berechnen und Gestalten im Maschinenbau ; ein Lehr- und Arbeitsbuch. 4., bearb. Berlin [u.a.]: Springer.

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

Courses (Type of course, Weekly hours per semester), Instructor:
Maschinenelemente - Grundlagen, Fertigung, Anwendung Übung (MW1694) (Übung, 3 SWS)
Zäh M, Busch M

Maschinenelemente - Grundlagen, Fertigung, Anwendung (MW1694) (Vorlesung, 2 SWS)
Zäh M, Busch M, Sigl M, Zhao X
For further information in this module, please click campus.tum.de or here.

Module Description

MW1108: Engineering Mechanics for Technology Management | Technische Mechanik für TUM-BWL

Version of module description: Gültig ab winterterm 2017/18

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
Credits:* 6	**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:
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:
Technische Mechanik für TUM-BWL (Vorlesung, 2 SWS)
Krempaszky C [L], Krempaszky C (Jahn Y)

Technische Mechanik für TUM-BWL - Vertiefungsübung (Übung, 2 SWS)
Krempaszky C [L], Krempaszky C (Jahn Y)

Technische Mechanik für TUM-BWL (Übung, 1 SWS)
Krempaszky C [L], Krempaszky C (Jahn Y)
For further information in this module, please click campus.tum.de or here.

Economics & Policy | Economics & Policy

Module Description

MGT001298: Economics of Technology & Innovation | Economics of Technology & Innovation

Version of module description: Gültig ab summerterm 2021

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

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

Description of Examination Method:
The examination form is a written exam (120 min.) in which the relevant content will be covered and the achievement of the planned learning goals can be checked. The final exam accounts for 100% of the final grade. The use of a calculator is allowed.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Economics I and Economics II

Content:
1. Fundamentals
1.1 Basic concepts of innovation economics (research and development, invention, innovation).
1.2 Innovations in the history of economic thought
1.3. Product and process innovations
1.4 Externalities (social benefits), incentives and optimal innovation activity
2 Innovation and Market Dynamics
2.1 Neoclassical economics of innovation
2.2 Competition and innovation
2.3 Networks and innovation (spillovers, lock-in effects, standards)
2.4. Research collaborations (cooperation and ""open innovation"")
2.5 Intellectual property (patents, licenses, market for technology)
3. Innovation policy
3.1 Technology indicators and their significance

3.2 (Inter)National innovation systems
3.3 Innovation policy:
3.4 Regulation and induced technological change
3.5 Direct and Indirect Government Support

Intended Learning Outcomes:
Upon completion of the course, students will be able to
- reproduce and explain essential aspects and fundamentals of innovation economics;
- explain and critically evaluate the innovation process, spanning from the search for new knowledge (R&D) to the economic application of such knowledge (innovation) to its market penetration (diffusion) in a competitive environment (incentives and effects), as well as the role of policy in this process;
- Derive and critically explain implications of innovation activity for market dynamics, i.e., growth of existing firms, emergence of new technologies and firms, and interactions among market participants (market and industry dynamics);
- explain and contrast economic models (competitive and cooperative models) as well as different approaches to innovation systems and the explanation of innovation;
- explain interdependencies between innovation incentives, (inter-)actions of market participants as well as the consequences of innovation activities and technological change.

Teaching and Learning Methods:
The teaching in this module involves lectures and exercise classes (tutorials). The latter involve the preparation of problem sets that can be solved in group work or individually.

Media:

Reading List:
Chapters 18 and 19 from “Industrial Organization - Markets and Strategies” by Paul Belleflamme and Martin Peitz, 2nd Edition, 2015, Cambridge University Press.
Chapter 5 of “Industrial organization: European perspective ” by Stephen Martin, 2001, Oxford University Press.
Chapters 14, 15 and 16 of “Industrial Organization in Context” by Stephen Martin, 2010, Oxford University Press.
"Innovation & Incentives" by Suzanne Scotchmer, 2004, MIT Press.

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

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

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

Bachelor's Thesis | Bachelorarbeit

Module Description

WI000693: Bachelor's Thesis | Bachelor's Thesis

Version of module description: Gültig ab winterterm 2012/13

Module Level: Bachelor	**Language:** German/English	**Duration:**	**Frequency:** winter/summer semester
Credits:* 12	**Total Hours:** 360	**Self-study Hours:** 360	**Contact Hours:**

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 evolves the own specific topic. Based on scientific knowledge and methodical skills, students autonomously discribe 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 successfull completion of 84 Credits in the basics of business amdinistration and the project study.

Content:
The Bachelor's Thesis focuses on a research topic in business adminstration 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 deploys 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. Therefor 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:
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.

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