Module Catalog

B.Sc. Chemical Biotechnology

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)
Technische Universität München

www.tum.de
www.cs.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.

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Module Description

WZ1600: Physics | Physik [Phys]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2015/16

Module Level:	Language:	Duration:	Frequency:
Bachelor	German	one semester	winter semester
Credits:*	**Total Hours:**	**Self-study Hours:**	**Contact Hours:**
5	150	90	60

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

Description of Examination Method:
Achievement of desired learning objectives shall be verified in a written final exam (90 minutes). In this respect the students demonstrate that they know and understand the concepts of mechanics, thermal engineering, electricity and optics. By using specific physical issues (mainly computational tasks) the students demonstrate that they are able to also use acquired concepts in a solution-oriented way in simple cases.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Good A-level knowledge of mathematics

Content:
The module of physics provides an introduction into classical physics. The module introduces into the math-based approach of physics for nature description. The module outlines the basics of mechanics, thermal engineering, electricity and optics, makes them clear by means of examples and further practices them by self-employed work.

Intended Learning Outcomes:
The module serves to acquire physical basics. The students know and understand the basic concepts of mechanics, thermal engineering, electricity and optics and can apply these concepts in simple cases. So a solid basis is created for the course participants which is necessary to understand the subsequent content of teaching (e.g. thermodynamics, energy technology).

Teaching and Learning Methods:
Lecture (speech by teaching staff including writing on the board, PP media, books and other written material), exercise (self-employed work on exercises related to the topics of the lecture in small groups with tutors) for further practising of the concepts which were presented in the lecture.

Media:
Writing on the board, presentations, slide scripts

Reading List:
U. Harten: Physik, Einführung für Ingenieure und Naturwissenschaftler (Physics, Introduction for Engineers and Scientists), 4th edition 2009, Springer
Paul A. Tipler: Physik (Physics), Spektrum (Panoply), Akademischer Verlag Heidelberg, Berlin, Oxford

Responsible for Module:
Kainz, Josef; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Physik (Übung) (Übung, 2 SWS)
Kainz J [L], Härtl S, Kainz J, Lugauer F

Physik (Vorlesung) (Vorlesung, 2 SWS)
Kainz J [L], Kainz J
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1601: Mathematics | Mathematik

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2015/16

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:
Learning outcomes shall be verified in a written test (90 min). Tasks shall be specified by means of which the students are to demonstrate that they know the mathematical methods imparted as part of the module and that they have understood and are able to apply them for specific case studies.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Knowledge in mathematics corresponding to basic knowledge of A-level students.

Content:
Selected mathematical methods required for calculations in the scientific, engineering or economic field, especially analysis (e.g. complete induction, differential and integral calculus, arithmetic progression and series), calculations with real and complex numbers as well as selected chapters of linear algebra (e.g. linear equation systems, matrices, eigenvalues and eigenvectors).

Intended Learning Outcomes:
The students know the most important mathematical methods required for calculations in the scientific, engineering or economic field. They have understood these methods and are able to calculate specific case studies and perform basic mathematical proof by means of complete induction.

Teaching and Learning Methods:
Lecture, presentation and associated exercises with independent processing and teamwork of specific examples. Mathematical methods shall be presented during the lecture. Within the scope of the exercise their application shall be practised based on specific case studies.

Media:
Digital presentation, writing on the board, exercise sheets

Reading List:
Forster, Otto 2004. Analysis 1 Vieweg Teubner Verlag

Responsible for Module:
Dominik Grimm (dominik.grimm@hswt.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Mathematik (Übung) (Übung, 2 SWS)
Grimm D [L], Grimm D

Mathematik (Vorlesung, 2 SWS)
Grimm D [L], Grimm D
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1611: Statistics | Statistik

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: 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:
Learning outcomes shall be verified in a written test (120 min). Tasks shall be specified by means of which the students are to demonstrate that they know the statistical methods imparted as part of the module and that they have understood and are able to apply them for specific case studies.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Qualification for university entrance: good mathematical knowledge is an advantage.

Content:
Selected statistical methods required for calculations in the scientific, engineering or economic field, especially from the field of descriptive statistics (e.g. Representation and description of distributions, indicators), calculus of probability as well as inductive statistics (e.g. confidence intervals, testing of hypotheses, regression analysis).

Intended Learning Outcomes:
The students know the most important statistical methods required for calculations in the scientific, engineering or economic field. They have understood this method and are able to select and perform suitable statistical procedures for specific case studies. Furthermore the students are able to understand statistics in technical literature (e.g. scientific journals).

Teaching and Learning Methods:
Lecture and associated exercise including independent processing of specific examples. Statistical methods shall be presented during the lecture. Within the scope of the exercise their application shall be practised based on specific case studies.

Media:
Lecture script, exercise sheets

Reading List:
Fahrmeir, Künstler, Pigeot, Tutz: Statistik - Der Weg zur Datenanalyse, Springer Verlag, ISBN: 978-3-642-01938-8; Kauermann, Küchehoff: Stichproben - Methoden und praktische Umsetzung mit R, Springer Verlag, ISBN: 978-3-642-12317-7

Responsible for Module:
Prof. Clemens Thielen

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

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

Module Description

WZ1922: General Chemistry | Allgemeine Chemie [Chem]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: 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:
The performance test will be in the form of a written examination rendered. The students should demonstrate in the exam the understanding of the structure of chemical compounds and their typical reactions and chemical conversions. It will also be tested the ability to formulate reaction equations, calculate reaction kinetic and thermodynamic parameters, as well as to transfer the acquired knowledge about the structure and reaction behavior of chemical substance groups to new chemical questions. No auxiliary means are allowed in the exam. 120 min examination time

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Knowledge of chemistry, mathematics and physics, which correspond to the basic course knowledge of the gymnasiale upper school

Content:
General principles of inorganic and physical chemistry: Atomic and molecular construction, structure of compounds, acid / base equilibria, redox reactions, thermodynamics,reaction kinetics and catalysis, fundaments on electrochemistry, selected reactions of inorganic chemistry

Intended Learning Outcomes:
The students will know and understand the basic principles of chemical reactions and will be able to formulate correct reaction equations and simple reaction kinetic and thermodynamic calculations. Moreover, they will be able to apply the knowledge acquired with model reactions about chemical transformations of chemical substances and substance groups to answer new

chemical questions. The successful participation in the module will enable the students to participate in the module of basic organic chemistry.

Teaching and Learning Methods:
Lectures and corresponding exercises with self analysis and workup of specific case studies. In relation to the teaching content exercise sheets are disbursed on which the students work in self-study before the tutorials. The solution and discussion takes place in the tutorials. At the postprocessing of the lecture exspecially while the exercises are solved the students keep themselves intensive busy with the teaching contents of the lecture and reach in this way a understanding of the structure and reaction behavior of chemical substance groups and practise the formulation of reaction equations.

Media:
Blackboard, presentation (using script), exercises.

Reading List:
1) Theodore L., H. Eugene LeMay, Bruce E. Bursten, Chemie Studieren Kompakt, 10. aktualisierte Auflage, Pearson Verlag, München;
2) Charles E. Mortimer, Ulrich Müller, Chemie, 10., überarbeite Auflage, Thieme Verlag, Stuttgart

Responsible for Module:
Riepl, Herbert; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Allgemeine und anorganische Chemie / Angleichung Chemie (Vorlesung) (Vorlesung, 2 SWS)
Riepl H [L], Able T, Chia-Leeson O, Hüsing T, Karl R, Laudage T, Riepl H, Urmann C

Allgemeine und anorganische Chemie (Übung) (Übung, 2 SWS)
Riepl H [L], Able T, Hüsing T, Laudage T, Riepl H, Urmann C
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1923: Physical Chemistry | Physikalische Chemie [PhysChem]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: 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:
The learning results are going to be proved in form of a written test (120 min). The students solve physical/chemical arithmetic problems and answer questions for definitions or physical/chemical relations. They prove that they have understood the basic relations of physical chemistry that are highlighted within the scope of the module and can use the systems of equations. Calculators are allowed additives. Other additives can be permitted by the lecturer as needed.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
A-level student knowledge of mathematics (especially differentiation and integration) and physics

Content:
Basics of chemical thermodynamics: laws of thermodynamics, forms of energy (U, H, G, S), relations of formulas; chemical equilibrium and chemical reactions; properties of gases; phase transition of pure substances and multiphase systems; two component systems; selected boundary surface phenomena; basics of reaction kinetics

Intended Learning Outcomes:
After successful completion of the module the students know the laws of thermodynamics; they are able to make calculations concerning U, H, S and G; they understand phase diagrams of one and two component systems, can create charts and calculate the condition of equilibrium of simple systems; they can calculate with partial molar quantities in multi component systems; they can use ideal and real gas equations; they are able to form and solve equations related to the kinetics of chemical reactions and to determine the order of reactions;

Teaching and Learning Methods:
Teaching methods: in the lecture the teaching content is communicated by a talk of the lecturer, supported by PowerPoint and sketches on the blackboard in which the latter form is chosen to derivate complex relations. To a limited extent this can be completed for selected topics by self-study of the textbook by the students. In relation to the teaching content exercise sheets are disbursed on which the students work in self-study before the tutorials. The solution and discussion takes place in the tutorials. Learning methods: at the postprocessing of the lecture especially while the exercises are solved the students keep themselves intensive busy with the teaching contents of the lecture and reach in this way a understanding of the physical-chemical relations and practise the usage of the systems of equations.

Media:
PowerPoint, whiteboard, exercise sheets, textbook, optional: script

Reading List:
Lehrbuch: P.W. Atkins, J. de Paula, Physikalische Chemie, 5. Auflage, Wiley-VCH, 2013

Responsible for Module:
Schieder, Doris; Dr. rer. nat.

Courses (Type of course, Weekly hours per semester), Instructor:
Physikalische Chemie (Vorlesung) (Vorlesung, 2 SWS)
Plumeré N [L], Honacker J, Plumeré N, Schieder D

Physikalische Chemie (Übung) (Übung, 2 SWS)
Plumeré N [L], Honacker J, Schieder D
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1924: Basic Organic Chemistry | Grundlagen Organische Chemie [OrgChem]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

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:
The performance test will be in the form of a written examination rendered. The students should demonstrate in the exam the understanding of the structure of organic chemical compounds and their typical reactions and chemical conversions. It will also be tested the ability to formulate reaction equations, as well as to transfer the acquired knowledge about the structure and reaction behavior of organic chemical substance groups to new chemical questions. No auxiliary means are allowed in the exam. 120 min examination time

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Knowledge of chemistry, mathematics and physics, which correspond to the basic course knowledge of the gymnasiale upper school

Content:
General principles of organic chemistry:
Structure of organic compounds, carbon-atom hybridization, important functional groups, nomenclature and structure of organic molecules, selected reactions of organic chemistry for important groups of substances including central natural substances.

Intended Learning Outcomes:
The students will know and understand the basic principles of organic chemical reactions and will be able to formulate correct organic reactions. Moreover, they will be able to apply the knowledge acquired with model reactions about chemical transformations of organic chemical substances and

substance groups to answer new chemical questions.The successful participation in the module will also enable the students to participate in the practical course and the module advanced organic chemistry.

Teaching and Learning Methods:
Lectures and corresponding exercises with self analysis and workup of specific case studies. In relation to the teaching content exercise sheets are disbursed on which the students work in self-study before the tutorials. The solution and discussion takes place in the tutorials. At the postprocessing of the lecture exspecially while the exercises are solved the students keep themselves intensive busy with the teaching contents of the lecture and reach in this way a understanding of the structure and reaction behavior of organic chemical substance groups and practise the formulation of reaction equations.

Media:
Blackboard, presentation (using script), exercises, laboratory equipment.

Reading List:
K.P.C. Vollhardt, N.E. Schore, Organische Chemie, Verlag VCH Weinheim

Responsible for Module:

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung
Organische Chemie
2 SWS

Übung
Organische Chemie
2 SWS
Cordt Zollfrank
For further information in this module, please click campus.tum.de or here.

Compulsory courses area chemistry | Pflichtmodule Chemie

Module Description

WZ1925: Practical Laboratory Course General Chemistry | Praktikum Allgemeine Chemie [Chem]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 60	**Contact Hours:** 90

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

Description of Examination Method:
Perfomance is going to be effected by a written protocol of the conducted lab experiments (for each experiment about 5 pages of protocol). In this protocol the students should prove their understanding of the structure of chemical compounds and aggregation states. In addition they should show that they understand chemical reactions and their thermodynamic and kinetic aspects. Furthermore should the students show that they are able to use lab instruments and equipment correctly for chemical experiments.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Knowledge of chemistry, mathematics and physics, which correspond to the basic course knowledge of the gymnasiale upper school

Content:
General principles of inorganic and physical chemistry and experimental essays: Structure of compounds, acid / base equilibria, redox reactions, thermodynamics, reaction kinetics, selected reactions of inorganic chemistry.

Intended Learning Outcomes:
The students will know and understand chemical structures, aggregation states of compounds and the basic principles of chemical reactions. The students will get familiar with the practical work

in chemical laboratories. They will be able to perform and formulate correctly chemical reactions, and experimentally determine thermodynamic and kinetic aspects of chemical reactions. The successful participation in the module will enable the students to participate in the module of basic organic chemistry

Teaching and Learning Methods:
Laboratory experiments and equipment.

Media:
Laboratory equipment.

Reading List:
1) Practical Labor Script; 2) Theodore L., H. Eugene LeMay, Bruce E. Bursten, Chemie Studieren Kompakt, 10. aktualisierte Auflage, Pearson Verlag, München;

Responsible for Module:
Herbert Riepl (h.riepl@wz-straubing.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Labor-Praktikum
Allgemeine und anorganische Chemie
6 SWS
Herbert Riepl
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1926: Practical training in basic organic chemistry | Praktikum Grundlagen Organische Chemie [POC]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

Module Level: Bachelor	**Language:** German	**Duration:** two semesters	**Frequency:** winter/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:
Attested experimental protocols (for each experiment about 5 pages of protocol). Data obtained from experimental work have to be evaluated and analyzed. If sufficient correlation with experimental results obtained by sample tests is obtained, the gained values are sufficiently analyzed and the experimental setup is correctly described, the respective experimental protocol is attested. In general, the practical training is attested, if 80% of all experimental protocols are approved.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic organic chemistry, inorganic chemistry

Content:
Boiling under reflux, crystalisation, distillation, isolation by succion, extraction with immiscible organic solvents, thin-layer-chromatography, column chromatography

Intended Learning Outcomes:
The students have obtained practical skills to perform reactions of the organic chemistry. By performing simple reactions, typical manual operations have been acquired. After completion of the practical course the students are able to correctly prepare, build up, conduct and document an experiment, to analyze the obtained result and to recognize possible causes of defaults.

Teaching and Learning Methods:
By own guided experimentation of students, use of chemicals and typical equipment is trained. Hereby manual skill and successful experimentation handicraft is obtained. About 10 experiments are conducted.

Media:
student teaching laboratory

Reading List:
H.G. Becker, Organikum, 21. Aufl., Wiley VCH

Responsible for Module:
Riepl, Herbert; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Praktikum
Organisch chemisches Praktikum
6 SWS
Herbert Riepl
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1927: Instrumental analysis and spectroscopy | Instrumentelle Analytik und Spektroskopie

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
Credits:* 8	**Total Hours:** 240	**Self-study Hours:** 135	**Contact Hours:** 105

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

Description of Examination Method:
The module exam consists of two parts, part one is a written test (90 min) to control the knwoledge about the theoretical basics of all treated analysis methods as only a part of these methods is practised. The second part consists of the evalution of the written protocols of the performed laboratory experiments (for each experiment about 5 pages of protocol). In these protocols the students should prove the understanding of the applied analysis methods and the correct handling of the analysis equipment. Furthermore the students prove that they record the laboratory experiments correctly and that they question their results critically and check them for plausibility. It is essential to learn the analysis methods extensively in theory and to apply them partly in practice, therefore two test forms exist in this module.Weighting written test/ protocol evaluation: 2:1.

Repeat Examination:
Next semester

(Recommended) Prerequisites:

Content:
In the module the basics of instrumental analysis are communicated. Thereby particular physicochemical characterization methods, basic principles of measurement and the setting of analysis instruments are disscussed in detail. In detail are these: optic/electricl/magnetic measuremnts, adsorption/desorption as basis for chromatopraphic techniques, adsorption/ desorption related to vibrational spectroscopy and UV/Vis spectroscopy, nuclear resonance spectroscopy, mass determination and spectrometry, scatter methods, atomic spectroscopy and

gas and high performance liquid chromatography. The handling of the received measuring results is explained by case studies.

Intended Learning Outcomes:
After visiting the required modul the students are able to select corresponding physicochemical analysis methods for underlying practical problems and to use these methods as needed. On the basis of the gained knowledge the students can analyse the obtained measuring results in a competent way.

Teaching and Learning Methods:
The theoretical basics of the experiments conducted in the practical course will be delivered in the lecture part via ppt-presentations, movies and white board. In the practical course, the students will self-reliantly perform, document and analyse their experiments.

Media:
presentation, script, cases and solutions lab and equipment

Reading List:
script, sample solutions for the exercises

Responsible for Module:
Zollfrank, Cordt; Prof. Dr. rer. silv.

Courses (Type of course, Weekly hours per semester), Instructor:
Instrumentelle Analytik und Spektroskopie (Übung) (Übung, 4 SWS)
Costa Riquelme R, Fernandez Cestau J, Fuenzalida Werner J, Riepl H, Rühmann B, Urmann C

Instrumentelle Analytik und Spektroskopie (Vorlesung) (Vorlesung, 3 SWS)
Zollfrank C [L], Costa Riquelme R, Fernandez Cestau J, Fuenzalida Werner J, Riepl H, Rühmann B, Urmann C
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1928: Advanced organic chemistry | Organische Chemie für Fortgeschrittene [AOC]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

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:
The students are able to demonstrate thier understanding of chemical reactions concerned in this course in a written exam with formula equations (90 min). The students show their understanding of different classes of natural compounds in formula equations.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
module basic organic chemistry

Content:
Fossil oil and natural gas as primary source, crack- und steam reforming reactions, technical olefin chemistry, technical aromatic chemistry, polyolefins, nitrogen containing organic intermediates, carboxylic acids and oxygen containing intermediates in polyester production. Chemistry of carbonyl compounds and carbohydrates.

Intended Learning Outcomes:
After successfully managing this module, the students are able to understand the chemical reactions of our fossil based chemical production. They can present product trees, based on side products or associated products. By this knowledge they can identify intermediates up to the ready polymer product. The students can apply typical reactions of different organic compounds.

Teaching and Learning Methods:
Lecture by academic teaching personell with PP-presentations, books, printed matter and others. Visit of production plants of nearby chemical industry to see typical industrial scale of reactions. In relation to the teaching content exercise sheets are disbursed on which the students work in self-study before the tutorials. The solution and discussion takes place in the tutorials. At the postprocessing of the lecture exspcecially while the exercises are solved the students keep themselves intensive busy with the teaching contents of the lecture and reach in this way a understanding of the chemical reactions of our fossil based chemical production and practise the presentation of product trees.

Media:
Powerpoint presentations, whiteboard, printed text of teaching

Reading List:
K. Weissermel, H.J.Arpe, Industrial Organic Chemistry, 4. Auflage, VCH Weinheim

Responsible for Module:
Riepl, Herbert; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung
Organische Chemie für Fortgeschrittene
2 SWS

Übung
Organische Chemie für Fortgeschrittene
2 SWS
Herbert Riepl / Cordt Zollfrank
For further information in this module, please click campus.tum.de or here.

Compulsory courses area molecular biology | Pflichtmodule Molekulare Biologie

Module Description

WZ1929: Cell biology and microbiology | Zell- und Mikrobiologie [MiBi]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

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:
The learning results are proved in a written test in which the students are to call up and remember important principles of biology without using additives. In addition the students prove that they are able to recognize and solve a problem in a certain time by answering the comprehension questions on covered basic cell and microbiology processes. Answering questions requires mainly the use of own formulations thereby the correct recall of important technical terms is additionally reviewed. During the examination the tasks are set in both languages and the processing of the examination tasks can take place either in German or English. Exam duration: 90 minutes

Repeat Examination:
Next semester

(Recommended) Prerequisites:

Content:
Basics of cell biology (cellular structure (cell wall, plasma membrane, endomembrane system, nucleus), differences between prokaryotic and eukaryotic organisms, theoretical basics of microscopy, transport processes, genetic flow of informations and basics of molecular genetics (e.g. DNA structure, transcription, translation, DNA duplication), basics of biological taxonomy using the example of selected production organisms (e.g. E.coli, S.cerevisiae, algae, fungi), usage of microorgamisms in industrial biotechnolgy (e.g. ethanol fermentation, ABE fermentation, protein synthesis)

Intended Learning Outcomes:
After having participated in the module units the students possess basic knowledge about the structure and function of biomolecules. They know important elements of pro- and eukaryotic cells and can differentiate between these life forms. They know the basics of the genetic flow of informations and of the most important metabolic pathways and can grade bacteria, fungi and plants to higher-ranking systematic groups. After completion of the module the participants know different microorganisms, can describe their properties and understand basic cellular processes. Furthermore, the students can reflect biological terms, define processes and are able to use their knowledge to solve problems.

Teaching and Learning Methods:
The teaching contents are imparted by a talk of the lecturer, supported by PowerPoint and blackboard sketches.

Media:
PowerPoint, blackboard work

Reading List:
„Allgemeine Mikrobiologie“ von Georg Fuchs von Thieme, Stuttgart (Broschiert - 11. Oktober 2006)
"Brock Mikrobiologie" von Michael T. Madigan und John M. Martinko, Pearson, 11. Auflage (2008)
"Biologie" von Neil A. Campbell und Jane B. Rice, Pearson, 8. Auflage (2011)

Responsible for Module:
Erich Glawischnig (egl@wzw.tum.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Zell- und Mikrobiologie (Vorlesung, 3 SWS)
Glawischnig E [L], Glawischnig E
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1930: Practical course microbiology | Praktikum Mikrobiologie

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

Module Level: Bachelor	**Language:** German	**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:
The performance is effected by written protocols of the executed laboratory experiments ((for each experiment about 5 pages of protocol). With these protocols the students prove that they are able to unterstand the theoretical background of the experiments, to report their experimental procedure and to evaluate their results. Furthermore, they should show that they can discuss deviations of the expected results and possible reasons.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Module Cell and Microbiology

Content:
Microscopy, methods of colony isolation, colony count, differentiation of bacteria, isolation of microorganisms, identification methods for microorganisms, bacteriophages, growth behaviour of microorganisms

Intended Learning Outcomes:
After module participation the students are familiar with the execution of experiments in microbiological labs and able to use the mediated microbiological working techniques at least in main features. They handle aseptic techniques and can identify microorganisms. In addition, they possess a deeper understanding of the theories which underlie the experiments. Furthermore, the students can report laboratory experiments in a correct way and evaluate and analyse them by means of the theoretical backgrounds under guidance.

Teaching and Learning Methods:
Laboratory experiments in small groups (approx. 10 experiments) under guidance with previous introduction of the theory related to the particular experiments (lecture) as well as analysis of the results by experiment reports. Aspects related to safety issues in the laboratory are also covered in the lectures.

Media:
Practical course script

Reading List:
Practical course script

Responsible for Module:
Erich Glawischnig (egl@wzw.tum.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung
Mikrobiologie
1 SWS

Praktikum
Mikrobiologisches Praktikum
4 SWS
Erich Glawischnig
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1631: Bioinformatics | Bioinformatik

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2015/16

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:
Learning outcomes shall be verified in a written test (90 min). Tasks shall be specified by means of which the students are to demonstrate that they know the bioinformatic methods imparted as part of the module and that they have understood and are able to apply them for specific case studies.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
WZ1603/WZ1929 Biology
WZ1616/WZ1931 Biochemistry

Content:
Selected bioinformatic methods required for calculations in the scientific field, especially from the area of biological databases (e.g.NCBI, Swissprot), algorithms for sequence alignments (e.g. Needleman-Wunsch, Smith-Waterman, ClustalW, BLAST), phylogenetic reconstruction as well as methods from structural bioinformatics (e.g. Pymol, Docking). Methods shall be presented during the lecture. Within the scope of the exercise their application shall be practised based on specific case studies.

Intended Learning Outcomes:
The students know the most important bioinformatic methods and databases (e.g. NCBI, Swissprot, Needleman-Wunsch, Smith-Waterman, ClustalW, BLAST, Pymol, Docking) required for calculations in the scientific field. They have understood this method and are able to select and perform suitable bioinformatic procedures for specific case studies.

Teaching and Learning Methods:
Lecture and associated exercise including independent processing of specific examples. The contents mediated by the lecture are outlined in the tutorial by means of concrete bioinformatic examples.The bioinformatic methods and algorithms which are presented in the lecture are proved and applied for concrete problems self-contained at the computer.

Media:
The lecture shall mainly be done by using powerpoint presentations. Introduction into bioinformatic software tools shall be done by using the corresponding internet pages. During the exercise the students work at PCs to independently implement skills learnt and gain confidence in working with the corresponding media and programmes.

Reading List:
Selzer, Marhöfer, Rohwer, 2008: Applied Bioinformatics, Springer Verlag

Responsible for Module:
Grimm, Dominik; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Bioinformatik (Vorlesung) (Vorlesung, 2 SWS)
Grimm D [L], Grimm D

Bioinformatik (Übung) (Übung, 2 SWS)
Grimm D [L], Grimm D
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1931: Biochemistry | Biochemie [BC]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

Module Level: Bachelor	**Language:**	**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 learning results are proved in form of a written test (90 min exam duration). Based on questions to biochemical metabolic pathways and enzymology the students prove that they know the corresponding technical terms, designations and contents, that they have understand the basic relations and are able to apply their knowledge concerning the reactions taking place within the scope of kinetic and thermodynamic connections. For that purpose concrete computational tasks are assigned.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Successful participation in the modules "Basic Organic Chemistry", "General Chemistry" and "Cell and Microbiology".

Content:
Enzymology: Within the module the students shall be introduced into basics of enzyme catalysis. In doing so theories relating to the course of enzymatic reactions, special aspects of kinetics and thermodynamics of enzyme-catalysed reactions, inhibition mechanisms as well as possibilities for calculating kinetic parameters shall be treated inter alia. Metabolism: Basic metabolic pathways such as glycolysis, citrate-cycle or gluconeogenesis shall be presented in the lecture. In doing so it is dealt with the general course of reaction cascades, thermodynamic aspects of energy generation as well as mechanisms of modulation of the individual paths.

Intended Learning Outcomes:
After sucessful completion of the module the students are able to describe and explain basic concepts, phenomenons and relations in the field of biochemistry. The students know important properties of proteins,understand the significance of kinetic parameters of enzymatic reactions and will be able to calculate them and apply to new issues (e.g. inhibition). Furthermore the students will be able to specify in detail basic metabolic pathways of the most important classes of substances, understand the particular steps and regulation systems of the respective paths.

Teaching and Learning Methods:
In the lecture the teaching content is imparted by speech of the lecturer using powerpoint presentations and blackboard sketches. Corresponding to the teaching content exercise sheets are prepared on which the students work in self-study. The solution and discussion of the exercises takes place in the tutorial.

Media:
Presentations, powerpoint, presentation script, exercise sheets

Reading List:
- Voet, D. , Voet, J.G., Biochemistry 4th Edition, Wiley-VCH, 2011;
- Nelson, D.L, Cox, M.M., Lehninger Principles of Biochemistry 5th Edition, WH Freeman, 2008;
- Berg, J.M, Tymoczko, J.L., Stryer, L., Biochemistry 6th Edition, 2006

Responsible for Module:
Josef Sperl (josef.sperl@tum.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Biochemie (Übung) (Übung, 2 SWS)
Al-Shameri A [L], Al-Shameri A

Biochemie (Vorlesung) (Vorlesung, 2 SWS)
Al-Shameri A [L], Al-Shameri A
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1932: Practical course biochemistry | Praktikum Biochemie [Pra BC]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter 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:
The learning results are reviewed by a oral exam (30 min duration) in which the students show that they unterstand the theoretical background of the experiments. Furthermore they should be able to report and discuss the most important results of their practical experiments and answer corresponding questions. In addition, the students prove by correct execution of all laboratory experiments with correct recording (for each experiment about 5 pages of protocol) that they can use the imparted experimental working techniques and can accordingly document laboratory experiments (not graded course achievement).

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Practical course microbiology

Content:
In the practical course commonly required basics for working in biochemical labs as well as special methods for separation and characterisation of molecules (amongst others ion exchange chromatography, size exclusion chromatogrpahie, thin-layer chromatography) are imparted. Furthermore, basic biochemical methods are imparted, especially the isolation of nucleic acids and proteins and their analysis by spectroscopy and gel electrophoresis as well as the analysis of enzyme-catalysed reactions.

Intended Learning Outcomes:
After module participation the students are familiar with the execution of experiments in biochemical labs and able to use the mediated experimental methods at least in main features.

In addition, they possess a deeper understanding of the theories which underlie the experiments. Furthermore, the students can report laboratory experiments in a correct way and evaluate and analyse them by means of the theoretical backgrounds under guidance. They can question their results critically and review them for plausibility.

Teaching and Learning Methods:
Laboratory experiments in small groups under guidance with previous introduction of the theory related to the particular experiments as well as analysis of the results by experiment reports. The students practice in excercises how to document and analyse experiments based on given case studies. The acquired skills are then applied by documenting and analysing own results. The students will conduct approx. 12 experiments.

Media:
Practical course script, PowerPoint presentations, blackboard sketch, lab, lab equipment

Reading List:
Practical course script

Responsible for Module:
Josef Sperl (josef.sperl@tum.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Praktikum Biochemie (Praktikum, 4 SWS)
Beer B, Hupfeld E

Praktikum Biochemie (Übung) (Übung, 2 SWS)
Beer B, Hupfeld E
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1933: Molecular biology and genetics | Molekularbiologie und Gentechnik

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

Module Level: Bachelor	**Language:** German	**Duration:** two semesters	**Frequency:** winter/summer semester
Credits:* 8	**Total Hours:** 240	**Self-study Hours:** 150	**Contact Hours:** 90

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

Description of Examination Method:
The performance of the exam consists of a written test (90 min) in which the students show that they are able to call up and structure their theoretical and practical knowledge and use it on problems. During the examination the tasks are set in both languages and the processing of the examination tasks can take place either in German or English. By creating written protocols of the executed laboratory experiments (for each experiment about 5 pages of protocol), the students prove that they can documentate and illustrate theoretical principles as well as the results and the corresponding analysis and assessment of the experiments (not graded course achievement).

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Module Biochemistry and module Practical course biochemistry

Content:
molecular structure of DNA, plasmids, bacteriophages, mutagenesis strategies, bacterial genomes, prokarotic gene regulation, transformation of organisms, genetic engineering, genetic engineering regulation, genome editing, cloning of DNA fragments, heterologous gene expression, analysis methods for DNA, RNA and proteins

Intended Learning Outcomes:
After completion of the modul the students possess knowledge about the most important molecular biological methods. They know how to isolate, analyse and manipulate nucleic acids and possess knowledge about the transformation of microorganisms. They understand what a genetically

engineered organism is and can assess the risks and benefits of genetic engineering experiments. The students can perform and analyse molecular biological experiments and name possible sources of error.

Teaching and Learning Methods:
The theoretical basics of the experiments conducted in the practical course will be delivered in the lecture part via ppt-presentations, movies and white board. In the practical course, the students will self-reliantly perform, document and analyse their experiments.

Media:
PowerPoint, blackboard work, practical course script

Reading List:
Molekulare Genetik: Knippers, ISBN: 987-3-13-477009-4, Bioanalytik: Lottspeich, ISBN: 978-3827400413, script

Responsible for Module:
Blombach, Bastian; Prof. Dr. rer. nat.

Courses (Type of course, Weekly hours per semester), Instructor:
Molekularbiologie (Vorlesung) (Vorlesung, 2 SWS)
Blombach B [L], Blombach B
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1934: Enzymes and their reactions | Enzyme und ihre Reaktionen

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

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:
The learning results are proved in form of a written test (90 min exam duration). Based on questions to biochemical metabolic pathways and enzymology the students prove that they know the corresponding technical terms, designations and contents, that they have understand the basic relations and are able to apply their knowledge concerning the reactions taking place within the scope of kinetic and thermodynamic connections. For that purpose concrete computational tasks are assigned.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Successful participation in the modules "Basic Organic Chemistry", "General Chemistry" and "Cell and Microbiology".

Content:
The course should give a broad overview of enzyme classes (oxidoreductases, isomerases, hydrolases, lyases, transferases and ligases) and of enzyme-catalysed reactions. Thereby different reaction mechanisms are examined from a chemical point of view and hence the usage of enzymes in simple chemical implementations and technical fields is derived and comprehensively illustrated. The role of complex cofactors (radical forming, redox-active, electron switching, ion stabilisating and so on) is introduced and hence the limitations of enzyme reaction are worked out. With data bases of enzyme reactions and thermodynamic dimensions (e.g. from the theory of group contribution methods) target compounds of enzyme reactions especially in the field of renewables utilization are made accessible.

Intended Learning Outcomes:
After sucessful completion of the module the students know and understand enzyme-catalysed chemical reactions. Based on this knowledge the students are able to design single- and multi-stage enzymatic processes and to evaluate them by means of thermodynamic and kinetic reaction data.

Teaching and Learning Methods:
In the lecture the teaching content is imparted by speech of the lecturer using powerpoint presentations, blackboard sketches and working on data bases. Corresponding to the teaching content exercise sheets are prepared on which the students work in self-study. The solution and discussion of the exercises takes place in the tutorial.

Media:
Presentations, PowerPonit, lecture script, exercise sheets, computer based work and enzyme reaction data bases

Reading List:
Voet, D. , Voet, J.G., Biochemistry 4th Edition, Wiley-VCH, 2011; Perry A. Frey und Adrian D. Hegeman, Enzymatic Reaction Mechanisms, Oxford Univ Press, 2006; Reinhard Renneberg, Darja Süßbier, Biotechnologie für Einsteiger, 3. Auflage, Spektrum Verlag Heidelberg 2010; A. Liese, K. Seelbach, C. Wandrey, Industrial Biotransformations, Wiley-VCH, 2006

Responsible for Module:
Sieber, Volker; Prof. Dr. rer. nat.

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung
Enzyme und ihre Reaktionen
2 SWS

Übung
Enzyme und ihre Reaktionen
2 SWS
Volker Sieber
For further information in this module, please click campus.tum.de or here.

Compulsory courses area process engineering | Pflichtmodule Verfahrenstechnik

Module Description

CS0001: Foundations of Computer Science | Grundlagen der Informatik

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2018/19

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:
Exam achievement shall be done in the form of a written test (90 minutes). Knowledge questions check the treated basic concepts of computer science. Small programming and modelling tasks test the ability to apply the learned programming and query languages and the modelling techniques in order to solve simple problems.

Repeat Examination:
Next semester

(Recommended) Prerequisites:

Content:
In the module following contents are treated exemplarily:
- database management systems, ER modelling, relational algebra and SQL
- Python as programming language:
o Basic constructs of imperative programming ((if, while, for, arrays etc.)
o Object-oriented programming (inheritance, interfaces, polymorphism etc.)
o Exception handling
- Basic algorithms and data structures:
o Algorithm term, complexity
o Data structures for sequences (linked lists, arrays, stacks & queues)
o Recursion

o Hashing (chaining, probing)
o Search (binary search, balanced search trees)
o Sorting (Insertion-sort, selection-sort, merge-sort)

Intended Learning Outcomes:
After successful participation in this module students will be able to understand important fundamental terms, concepts and approaches of computer science. Particularly the students know fundamental concepts of programming, databases as well as algorithms and data structures.They are enabled to apply the learnt concepts to develop own programms for data storage and analysis.

Teaching and Learning Methods:
Lecture and practical exercises: In addition to a central exercise,
in which the concepts of the lecture were deepend on the basis
of examples, tutorials, in which simple tasks were solved on the computer under intensive support, impart important practical
basic skills of programming, in order to apply the self-study acquired knowledge. In the second half of the semester
students work on a practical project, that should deepen the
related unterstanding with regard to the desired learning
outcomes.

Media:
Slide presentation, blackboard, lecture and exercice recording, discussion forums in e-learning platforms; Working on the PC

Reading List:
- Heinz-Peter Gumm, Manfred Sommer, 2012, Einführung in die Informatik, Degruyter Oldenbourg
- Marco Emrich, 2013, Datenbanken & SQL für Einsteiger, Create space independent publishing platform

Responsible for Module:
Dominik Grimm (dominik.grimm@hswt.de)

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

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

Module Description

WZ1935: Chemical reaction engineering | Chemische Reaktionstechnik

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2018/19

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:
Learning outcomes of the students shall be verified in a written test. Through this test they show that they are able to outline and explain kinetics in technical reactors in a diagrammatic way. They demonstrate that they are able to answer questions on the fundamentals of catalysis as a chemical formula equation. Based on different tasks (including computational tasks) the ability is verified to use acquired knowledge within limited time for solving fundamental process technology issues (dimensioning of stirrers, tube reactors etc.). Exam duration: 90 minutes
For questions regarding the language of the exam, please seek contact with the lecturer.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
general inorganic and organic chemistry, physics, mathematics

Content:
Reaction kinetics, catalysts, features of homogeneous and heterogeneous catalysis; chemical reaction technology: homogeneous/heterogeneous reactions, reactor forms (e.g. stirrer tanks, tube reactor, packed bed, fluidized bed), indicators for reactor types (e.g. reaction vessels, flow tube), types of reaction control (e.g. fixed, not fixed, continuous, isothermal), flow conditions and residence time behaviour in reactors, heat balance of reactors, strategies for optimising reaction control.

Intended Learning Outcomes:
After having participated in the module the students are familiar with the most important reaction types and parameters of chemical catalysis and reaction technology and are able to apply suitable

reaction controls for predefined chemical reactions and to perform kinetic calculations for common reaction types as well as to calculate parameters such as residence time behaviour and heat demand of reactors. Thus they are capable of also transferring methods learned from examples to new processes.

Teaching and Learning Methods:
The module consists of lectures and parallel tutorials. Contents of the lecture shall be imparted in speech and by presentation. To deepen their knowledge students shall be encouraged to study the literature and examine with regards to content the topics. In the exercises performed as part of the module learned theory shall directly be applied with a practical orientation by means of arithmetic examples.

Media:
Black board, presentation sheets, exercise sheets

Reading List:
O. LEVENSPIEL:
Chemical Reaction Engineering
3. Auflage, John Wiley & Sons, New York (1998)

G. EMIG, E. KLEMM:
Chemische Reaktionstechnik
6. Auflage, Springer Vieweg, Berlin (2017)

Responsible for Module:
Jakob Burger (burger@tum.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Chemische Reaktionstechnik / Prozesstechnik (Übung) (Übung, 2 SWS)
Burger J

Chemische Reaktionstechnik / Prozesstechnik (Vorlesung) (Vorlesung, 2 SWS)
Burger J [L], Burger J
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1936: Mixture thermodynamics and mass transfer | Thermodynamik der Mischungen und Stofftransport

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2018/19

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:
The exam performance is effected by a written test. The familiarising of the students with the basics and methods of molecular mass transport and the thermodynamics of mixed phases as well as the reference to real assignment of tasks is reviewed by calculations and by the evaluation of diagrams. The students prove the comprehension of the content of the module by application of the learned relations. Thereby the whole procedural spectra is extended for the chemical and material topics. The students calculate chemical equlibria and phase equilibria. Exam duration: 120 minutes.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basics of Mathematics, Physics and Chemistry, Physical Chemistry

Content:
Introduction to phenomenological thermodynamics, data on chemical media, mass transport phenomena and equilibrium state. Graphical presentation of state variables, thermal state equations for ideal and real pure substances, Gibbs's Thermodynamics, application of the Maxwell's relations (Maxwell's equations), caloric standard data, thermodynamics of mixtures, calculation of chemical and phase equilibria, basics of molar transition and equilibria in one and between several phases (mass transition, diffusion processes, mass transfer), chemical potential, ideal and real phase equilibria, equilibrium coefficients, equilibrium diagrams, mass/ energy/ momentum balance, Fick´s law, film theory, penetration theory.

Intended Learning Outcomes:
The lecture is aimed at familiarising the students with the basics and methods of molecular mass transport and the thermodynamics of mixed phases. Thereby they are qualified to understand the different calculation methods for material properties and phase equilibria in process engineering and to estimate their application possibilities and limits. Thereby the basics for further understanding of thermal and chemical processes are laid.

Teaching and Learning Methods:
The module consists of a lecture during which also exercises will be performed alternately. Contents of the lecture shall be imparted in speech and by presentation. To deepen their knowledge students shall be encouraged to study the literature and examine with regards to content the topics. In the exercises performed as part of the module learned theory shall directly be applied with a practical orientation by means of arithmetic examples.

Media:
Presentations, slide scripts, exercises

Reading List:

Responsible for Module:
Burger, Jakob; Prof. Dr.-Ing.

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

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

Module Description

WZ1938: Fluid separation processes | Thermische Verfahrenstechnik [TVT]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2018/19

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:
The exam performance is effected by a written test. Arithmetic problems concerning fluid separation processes are assigned. Therefore design and mass balance study of process steps and implementation of basic concepts and relations in the field of fluid separation processes are proven. Exam duration: 90 minutes.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Physical Chemistry, Mixture thermodynamics and mass transfer

Content:
Introduction to fluid separation processes, design methods (calculation and graphical), single-stage and multi-stage operations, Mc-Cabe-Thiele-Construction, HTU-NTU-concept, fixed-point construction for extraction columns, feasibility limiations of unit operations. Applications in the field of distillation, absorption, extraction, membranes, adsorption.

Intended Learning Outcomes:
After completion of the module, the studens are able to design and assess the fluid separation processes distillation, extraction, absorption and membranes based on state diagrams. In addition, the students understand the basic principles of the said separation processses and the apparatus employd in an industrial context.

Teaching and Learning Methods:
The module consists of a lecture during which also exercises will be performed alternately. Contents of the lecture shall be imparted in speech and by presentation. To deepen their knowledge students shall be encouraged to study the literature and examine with regards to content the topics. In the exercises performed as part of the module learned theory shall directly be applied with a practical orientation by means of arithmetic examples.

Media:
Presentations, scripts, exercises

Reading List:

Responsible for Module:
Jakob Burger (burger@tum.de)

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

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

Module Description

WZ1939: Practical course Process Engineering | Praktikum Allgemeine Verfahrenstechnik [PVT]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 75	**Contact Hours:** 75

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

Description of Examination Method:
In the practical course, the exam is taken by positively elaborated written internship reports (for each experiment about 5 pages of report). Thereby the correct presentation of the theoretical basics, the reproduction of the experimental procedure and the correct data evaluation are essential. Thereby the students show that they understand basic processes and principles of process engineering and that they can design and calculate corresponding transformations.
The students prove that they can execute and evaluate metrological experiments in small groups (2-3 persons).

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Chemical and thermal process technology, Technical Thermodynamics, Chemical Thermodynamics and Mass Transport

Content:
Basic operations of process engineering, especially from the chemical, thermal and mechanic range e.g. destillation or particle distribution analysis.The content and the number of experiments are chosen from a of multiplicity of basic operations and rely on the available laboratory equipment.

Intended Learning Outcomes:
After graduation of the practical course, the students know basic processes and principles of process engineering (e.g. destillation, extraction, desiccation or particle distribution analysis and

separation from a gas flow). They know how to design and calculate a chemical, physical or mechanic transformation. Furthermore, they know the process steps which are necessary for it.

Teaching and Learning Methods:
The acquisition of basic principles is prepared by handed out literature.
The student learns the theoretical understanding, the basic engineering of the experiment and the correct use of the installed measurement technique through the graduation of the practical course. The acquisition of these properties is proved at the day of the experiment and comfirmed by producing a report. Thereby also the ability is reviewed to evaluate and report data correctly.

Media:
Practical course script, laboratory equipment

Reading List:
Practical course script

Responsible for Module:
Burger, Jakob; Prof. Dr.-Ing.

Courses (Type of course, Weekly hours per semester), Instructor:
Praktikum Verfahrenstechnik I (Praktikum, 5 SWS)
Burger J [L], Baumeister E, Burger J, Göttl Q, Wolf C
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1940: Bioprocess Engineering | Bioverfahrenstechnik [BPE]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: 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:
To proof whether the students acquired detailed and differentiated knowledge about concepts, calculations and the general design of various bioprocesses, a written examination takes place with a duration of 60 minutes. A bonus of 0,3 is credited on the grade of this written examination when during the module at least 65% of the exercise sheets are handed in and are marked with a positive result (an increase of the grade from 4,3 to 4,0 is not possible). Thereby students shall be motivated to participate in the tutorial which is very important for them.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:

Content:
The lecture provides a fundamental overview of bioprocess engineering including all relevant process parameters, calculations and balances.This includes basic calculations of generation times, maximal specific growth rates as well as balancing of batch, fed-batch and continous fermentation processes. Furthermore, process relevant parameters such as oxygen transfer rates and heat transfer will be conveyed. Additionally, basic operation unit design as well as scale-up aspects will be examined.

Intended Learning Outcomes:
The students acquire detailed and differentiated knowledge about concepts of various bioprocesses. Finally they are able to describe, calculate and design classical as well as complex

bioprocesses. They will be able to evaluate the applicability of mathematical modelling of bioprocesses and will use this knowledge to analytically simplify highly complex process variants.

Teaching and Learning Methods:
The lecture will be perormed as ex-cathedra teaching to provide the students will all necessary fundamentals. Within the tutorial the students learn how to transfer this knowledge and get practically used with the content of the lecture. The tutorial will be used to internalise the theoretical knowledge based on case studies which allows the transformation on real-world as well as highly specific challenges of bioprocesses.

Media:
PowerPoint, short films, scripts, exercise sheets

Reading List:

Responsible for Module:
Schmid, Jochen; Prof. Dr.-Ing. habil.

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

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

Module Description

WZ1941: Practical course Bioprocess Engineering | Praktikum Bioverfahrenstechnik [PCBPE]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 75	**Contact Hours:** 75

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

Description of Examination Method:
To proof whether the students acquired detailed and differentiated knowledge about concepts, calculations and the general design of various bioprocesses, records of the different experiments have to be handed in (for each experiment about 5 pages of record). Data obtained from experimental work have to be evaluated and analyzed. If sufficient correlation with experimental results obtained by sample tests is obtained, the gained values are sufficiently analyzed and the experimental setup is correctly described, the respective experimental protocol is attested. In general, the practical training is attested, if at least 65% of all experimental protocols are approved.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:

Content:
The practical course provides deepened insights of the lecture of bioprocess engineering which will be achieved by experimental confirmtion of the theretical content.This includes the analysis of typical parameters such as maximal specific growth rates as well as balancing of batch, fed-batch and continous fermentation processes. Furthermore, process relevant parameters such as oxygen transfer rates and heat trasnfer will be conducted. Additionally, basic operation unit design as well as scale-up aspects will be experimental analysed.

Intended Learning Outcomes:
The students acquire detailed and differentiated knowledge about concepts, calculations and the general design of various bioprocesses to optimize the processes. Additionally, they will be able to transfer these results on more complex or specific challenges.

Teaching and Learning Methods:
The practical course is based on defined experiments on the topics of: fermentation, mixing and stirring, oxygen transfer, calculation and characterization of tube flows. Main aim is the evokening of problem oriented thinkinig of the students by encouranging selfemployed working methods. Based on data aquisition the process technological characteristics are calculated and evaluated.

Media:
PowerPoint, short films, scipts, exercise sheets

Reading List:

Responsible for Module:
Schmid, Jochen; Prof. Dr.-Ing. habil.

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

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

Module Description

WZ1942: Process Design Project | Anlagenprojektierung

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** summer semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 60	**Contact Hours:** 90

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

Description of Examination Method:
The exam performance consists of a project planning in the group and preparation of a group presentation of the main results of the project treatment in the group that records the assignment of tasks, the detailed course of action of the students and the calculation as well as the beyond obtained results. The presentation shows whether the students have learned all the steps which belong to the design of a technical process. The completion of the project work constitutes of a short presentation (15 min) of the students.Thereby the presentation is performed to the other participants of the module (not graded course achievement).

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Chemical and thermal process technology, Technical Thermodynamics, Chemical Thermodynamics and Mass Transport

Content:
The content consists of a project work in basic engineering and the corresponding design of a exemplary process or of parts of the process, the usage of calculation tools (like Excel, Mathcad), the examination of profitability and of the basics of project management in line with the teamwork.

Intended Learning Outcomes:
After completion of the module the students know how to approach the planning of a technical assignment of tasks. They are able to acquire required informations, to dimension the system in a correct way and examinate its profitability. So the students can design technical processes. Thereby the reference to real design is laid and the students are able to apply basic work steps.

Teaching and Learning Methods:
The groups are tackled with a design task which can be solved by a correct information search and execution of sub-steps. The formulation of solution(s) is carried out in groups consisting of 2 to 4 students. The lecturers support this learning process by continuous interaction. Thereby the knowledge is intensified in supervised teamworks whereby the expertise is clearly strengthened.

Media:

Reading List:

Responsible for Module:
Burger, Jakob; Prof. Dr.-Ing.

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

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

Research Internship | Forschungspraktikum

Module Description

WZ1943: Research Internship | Forschungspraktikum

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

Module Level: Bachelor	**Language:** German/English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 10	**Total Hours:** 300	**Self-study Hours:** 60	**Contact Hours:** 240

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

Description of Examination Method:
Exam achievement consists of a graded practical course report (10-15 pages) about contents and results of the practical course containing at least an overview of the level of knowledge relating to the project subject as well as representation of used working methods and a representation of the results including interpretation. In a final grade quality of familiarisation with the topic of experimental work, interpretation of results and written elaboration shall be evaluated.

Repeat Examination:
Next semester

(Recommended) Prerequisites:

Content:
Research-related works at the chairs and working groups of the WZ (Science Centre) of Straubing. The students shall each get tasks from the research field of the mentoring examiner. They shall work on these tasks under supervision in form of projects. Topics have to be allocated with regard to content and expertise to one of the core themes (cultivation, economy, material use, energetic use). The students shall largely independently plan project works under supervision of the mentors. Project works shall be documented and evaluated in form of an internship report. Optionally a completing presentation of work progress may be done in form of oral presentations. Project works can also be done in cooperation with external institutions, e.g. companies.

Intended Learning Outcomes:
After having participated in the module the students especially understand principles of approach to (research) projects, planning of project works and critical evaluation of project results beside subject-specific knowledge and working methods each imparted in the practical course in scientific working. The students will be able to apply these principles to new project tasks. Besides they are able to document, to interpret and summarise project works and results in a meaningful way in written form.

Teaching and Learning Methods:
According to the core theme and topic, e.g. experimental equipment (laboratory), databases, libraries, subject-specific software, project and experiment design software

Media:
dependent on focus and topic e.g. experimental equipment (lab), databases, libraries,subject-specific software, project/ experiment planning software

Reading List:
Technical literature

Responsible for Module:
Volker Sieber (sieber@tum.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Forschungspraktikum Bachelor Pflichtmodul (Praktikum, 16 SWS)
Blombach B [L], Blombach B, Glawischnig E, Siebert D, Thoma F

Forschungspraktikum Bachelor Pflichtmodul (Praktikum, 16 SWS)
Burger J [L], Baumeister E, Burger J, Tönges Y, Voggenreiter J

Forschungspraktikum Bachelor Pflichtmodul Prof. Gaderer (Forschungspraktikum, 8 SWS)
Gaderer M [L], Klüh D

Forschungspraktikum CBT-Bachelor WZ1943 (Prof. Sieber) (Praktikum, 10 SWS)
Sieber V [L], Rühmann B
For further information in this module, please click campus.tum.de or here.

Electives | Wahlmodule

Technical Electives | Fachspezifische Wahlmodule

Module Description

WZ2647: Legal Aspects of Biotechnology | Angewandte und rechtliche Aspekte der Biotechnologie

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2012/13

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
Credits:* 4	**Total Hours:** 120	**Self-study Hours:** 78	**Contact Hours:** 42

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

Description of Examination Method:
Prüfungsdauer (in min.): je V 90.
Die theoretischen Kompetenzen werden durch zwei Klausuren (je 90 min) ermittelt. Dies ist notwendig, da sich ein Teil des Moduls auf die rechtlichen Aspekte der Biotechnologie bezieht, der andere auf die angewandte und auf die Industrie ausgerichtete Biotechnologie (Roche-Ringvorlesung).

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Grundlagen der Biochemie und Immunologie

Content:
V Teil A: Gentechnikgesetz, Gefahrstoff- und Sicherheitsrecht, Gute Laborpraxis, Patentierung und Vermarktung biotechnologischer Erfindungen, Patentrecht, Gründung von Biotechnologie-Unternehmen; V Teil B: Industrielle Biotechnologie im Gesundheitsbereich, Therapeutische Proteine und Antikörper, Molekulare Onkologie, Herstellung therapeutischer Proteine, Personalisierte Medizin, Biomarker und Pharmaco-Diagnostik, Der Biopharmazeutika-Markt

Intended Learning Outcomes:
Nach der Teilnahme an diesem Modul ist der Studierende in der Lage, den rechtlichen Rahmen für die Biotechnologie, das Gentechnikgesetz, die gesetzlichen Bestimmungen für gentechnisches Arbeiten im Labor, das Gefahrstoff- und Sicherheitsrecht, das Arbeiten unter den Bedingungen der Guten Laborpraxis, Voraussetzungen für die Patentierung und Vermarktung biotechnologischer Erfindungen sowie die wesentlichen Aspekte bei der Gründung eines Biotechnologie-Unternehmens zu verstehen. Weiterhin werden im Rahmen der Studienkooperation mit der Firma Roche Kenntnisse der Industriellen Biotechnologie vermittelt, insbesondere hinsichtlich der industriellen Herstellung therapeutischer Proteine sowie der Entwicklung neuer innovativer Proteintherapeutika. Die Studierenden erhalten weiterhin einen Überblick über den Biopharmazeutika--Markt sowie einen Einblick in die Anwendungen und das Potential der Biomarker.

Teaching and Learning Methods:
Vorlesung

Media:
Präsentation (PowerPoint)

Reading List:
Keine

Responsible for Module:
Arne Skerra (skerra@tum.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Rechtliche Grundlagen der Biotechnologie, Sicherheits- und Patentrecht (Vorlesung, 1 SWS)
Skerra A [L], Schlapschy M, Eichinger A

Ringvorlesung "Industrielle Biotechnologie - von der Idee zum Produkt" (Vorlesung, 1 SWS)
Skerra A [L], Skerra A
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1950: Biopolymers | Biopolymere [Biopol]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: summerterm 2020

Module Level:	Language:	Duration:	Frequency:
Bachelor	German	one semester	winter semester
Credits:*	**Total Hours:**	**Self-study Hours:**	**Contact Hours:**
5	150	105	45

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

Description of Examination Method:
The learning results are going to be proved in form of a written test (90 min). The students answer questions about biopolymers and their physicochemical properties. They prove that they have gained knowledge about the discrimination, classification and extraction of biopolymers within the scope of the module and are able to apply this knowledge. No additives are allowed.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic principles chemistry, physics and biology

Content:
The module deals with the structure and the function of polymers derived from nature (biopolymers). Covered are proteins, polysacharides, biogenic polyester, polyisoprenes and lignin. It is illustrated how bioploymers can be obtained from natural sources and which chemical reactions they are able to perform. Thereby the importance of the microstructure as well as the importance of the physicochemical properties in biological functions for the application-technical relevance of the biopolymers used as raw and functional material are covered.

Intended Learning Outcomes:
By attending the module the students are able to discriminate biopolymers and to classify them application-oriented. They know how and from which natural sources biopolymers can be obtained. The students acquire basic knowledge in the understanding of biopolymers and their physicochemical properties and can describe these properties and compare them among each other. Thereby they are able to differentiate suitable biopolymers application-oriented.

Teaching and Learning Methods:
Teaching methods: in the lecture the technical contents are communicated by a talk of the lecturer, supported by PowerPoint and skectches on the blackboard. In relation to the teaching content written tasks are disbursed on which the students work in self-study before the tutorials. The solution and discussion of the tasks as well as the visulaization of the teaching content by working with molecular models takes place in the tutorials. Learning methods: at the postprocessing of the lecture exspcecially while the exercises are solved the students keep themselves intensive busy with the teaching contents of the lecture and reach in this way a comprehensive knowlegde about biopolymers.

Media:
Lecture, blackboard sketch, foil script, molecular models

Reading List:
Türk, Oliver: Stoffliche Nutzung nachwachsender Rohstoffe
Grundlagen - Werkstoffe - Anwendungen, Springer Verlag

Responsible for Module:
Zollfrank, Cordt; Prof. Dr. rer. silv.

Courses (Type of course, Weekly hours per semester), Instructor:
Biopolymere (Seminar) (Seminar, 1 SWS)
Zollfrank C [L], Zollfrank C

Biopolymere (Vorlesung) (Vorlesung, 2 SWS)
Zollfrank C [L], Zollfrank C
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1946: Chemistry and structure of biopolymers | Chemie und Struktur der Biopolymere [CSB]

= Combination of the Module WZ1950 Biopolymers and the lecture "Basic principles of electron microscopy"

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: summerterm 2020

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
Credits:* 8	**Total Hours:** 240	**Self-study Hours:** 165	**Contact Hours:** 75

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

Description of Examination Method:
The learning results are going to be proved in form of a written test (90 min). The students answer questions about biopolymers and their physicochemical properties as well as the functionalities and imaging modes of scanning electron and transmission electron microscopes and the corresponding sample preparation routes. They prove that they have gained knowledge about the discrimination, classification and extraction of biopolymers and the basics of electron diffraction and continuative techniques within the scope of the module and are able to apply this knowledge. No additives are allowed.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic principles chemistry, physics and biology

Content:
The module deals with the structure and the function of polymers derived from nature (biopolymers). Covered are proteins, polysacharides, biogenic polyester, polyisoprenes and lignin. It is illustrated how bioploymers can be obtained from natural sources and which chemical reactions they are able to perform. Thereby the importance of the microstructure as well as the importance of the physicochemical properties in biological functions for the application-technical relevance of the biopolymers used as raw and functional material are covered. In addition the basics of electron microscopy are covered (wave theory, properties of electrons,

properties of X-radiation, radiation protection, electron-optical elements, scanning electron microscopy technology, imaging modes, secondary and backscatter electrons, transmission electron microscopy technology, imaging modes, bright and drak field, basic diffraction methods, high-resolution techniques, analytical components, special applications, sample preparation).

Intended Learning Outcomes:
By attending the module the students are able to discriminate biopolymers and to classify them application-oriented. They know how and from which natural sources biopolymers can be obtained. The students acquire basic knowledge in the understanding of biopolymers and their physicochemical properties and can describe these properties and compare them among each other. Thereby they are able to differentiate suitable biopolymers application-oriented.
In addition, after completion of the module the students are able to describe the functionalities and imaging modes of scanning electron and transmission electron microscopes. They can name the rules and guidelines of radiation protection and basic sample preparation routes for a given analytical method. They can name the basics of electron diffraction and continuative techniques. On the basis of this knowledge they can assign a given dataset of biopolymers which was produced by electron microscopy to its radiographic technique and apply basic interpretation principles.

Teaching and Learning Methods:
Teaching methods: in the lecture the technical contents are communicated by a talk of the lecturer, supported by PowerPoint and skectches on the blackboard. In relation to the teaching content written tasks are disbursed on which the students work in self-study before the tutorials. The solution and discussion of the tasks as well as the visulaization of the teaching content by working with molecular models takes place in the tutorials. Learning methods: at the postprocessing of the lecture exspcecially while the exercises are solved the students keep themselves intensive busy with the teaching contents of the lecture and reach in this way a comprehensive knowlegde about biopolymers.

Media:
Lecture, blackboard sketch, foil script, molecular models

Reading List:
Türk, Oliver: Stoffliche Nutzung nachwachsender Rohstoffe
Grundlagen - Werkstoffe - Anwendungen, Springer Verlag
Scanning Electron Microscopy - Physics of Image Formation and Microanalysis
Autoren: Professor Dr. Ludwig Reimer ISBN: 978-3-642-08372-3
Transmission Electron Microscopy - A Textbook for Materials Science
Autoren: David B. Williams, C. Barry Carter ISBN: 978-0-387-76500-6

Responsible for Module:
Zollfrank, Cordt; Prof. Dr. rer. silv.

Courses (Type of course, Weekly hours per semester), Instructor:
Grundlagen der Elektronenmikroskopie (Vorlesung) (Vorlesung, 2 SWS)
van Opdenbosch D, Zollfrank C

Biopolymere (Vorlesung) (Vorlesung, 2 SWS)
Zollfrank C [L], Zollfrank C

Biopolymere (Seminar) (Seminar, 1 SWS)
Zollfrank C [L], Zollfrank C
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1951: Computational Biology and Functional Genomics | Computational Biology and Functional Genomics

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2018/19

Module Level: Bachelor	**Language:** German/English	**Duration:** one semester	**Frequency:** winter/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:
Learning outcomes shall be verified in a written test (90 minutes). Tasks shall be specified by means of which the students are to demonstrate that they know the bioinformatic methods imparted as part of the module and that they have understood and are able to apply them for specific case studies.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Module Biochemistry, WZ1631 Bioinformatics, CS0001 Foundations of Computer Science

Content:
Current methods in bioinformatics for analysing complex Current methods in bioinformatics for analysing complex dynamical and biological systems. The following topics are treated exemplarily:
• Next-Generation Sequencing Data Analyses
o Quality Control, Data Preprocessing
o Genom-Assembly and Genom-Mapping
o SNP and SV Calling
• Genexpression & RNA-Seq
o Microarray Analyses
o RNA-Seq Analyses
• Bisulfite Sequencing & Epigenetics
• Microbiom-Analyses
• Single Cell Sequencing

Intended Learning Outcomes:
The students acquire detailed and differentiated knowledge about bioinformatic methods and algorithms to handle complex bioinformatic problems. The students are able to deduce an appropriate bioinformatic research design to investigate selected research questions. They can documentate and analyse applied scientific methods and obtained results in a written form.

Teaching and Learning Methods:
Lectures to provide the students with the theoretical and practical concepts of state-of-the-art bioinformatics methods, which they will need to independently apply these methods on real-world data. Tutorial with independent processing of selected research questions, the theoretically mediated contents are outlined by means of concrete bioinformatic research questions. The presented bioinformatic methods and algorithms are applied on concrete problems self-contained at the computer. Furthermore it is imparted to the students how they can scientifically document the applied bioinformatic methods and the results obtained.

Media:
PowerPoint presentations and blackboard. During the exercise the students work independently on PCs to apply the learnt methods on various case-studies.

Reading List:
Bioinformatics and Functional Genomics, Jonathan Pevsner, 2017

Responsible for Module:
Dominik Grimm (dominik.grimm@tum.de)

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

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

Module Description

WZ1953: Downstream Processing | Downstream Processing [DSP]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

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

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

Description of Examination Method:
The teaching content will be evaluated by a written examination for the learning outcomes of the module of a duration of 60 minutes. Based on questions to definitions and methods of Down-stream processes of biologically inspired processes the students prove that they know the corresponding technical terms, designations and contents, that they have understand the basic relations and are able to apply their knowledge.

Repeat Examination:
Next semester

(Recommended) Prerequisites:

Content:
The lecture provides a fundamental overview of Downstream procesing of bioprocesses, which includes all relevant process parameters up to the effects of targeted approaches on the wholistic system.

Intended Learning Outcomes:
The students acquire detailed and differentiated knowledge about concepts and definitions of Down-stream processes of biologically inspired processes. This includes the different approaches of precipitation, filtration as well as targeted converions which massively contribute to economical bioprocesses.

Teaching and Learning Methods:
The lecture will be perormed as ex-cathedra teaching to provide the students will all necessary fundamentals which they will need for insights in the different downstream processing approaches.

Media:
PowerPoint, short films, scripts

Reading List:

Responsible for Module:
Schmid, Jochen; Prof. Dr.-Ing. habil.

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

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

Module Description

CS0178: Introduction to Game Theory | Einführung in die Spieltheorie

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2020/21

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:
Assessment takes an oral form (25 minutes). Students show the extent to which they have understood the taught definitions and terminology from the area of cooperative and non-cooperative games. They show to which extend they are able to use games in order to model problems from economics and engineering. They are also expected to apply important solution concepts to concrete games. Students demonstrate their understanding of these solution concepts when answering comprehension questions concerning their properties and the advantages and disadcantages of the different concepts.

Repeat Examination:
Next semester

(Recommended) Prerequisites:

Content:
Cooperative and non-cooperative games, solution concepts for cooperative games, core, Shapley value, solution concepts for non-cooperative games, pure Nash equilibria, mixed Nash equilibria, dominant strategies, Bayesian games

Intended Learning Outcomes:
Students have aquired basic theoretical and practical knowledge on cooperative and non-cooperative games. They know the basic definitions and terminology and are able to model problems from economics and engineering as games. Students know the most important solution concepts for cooperative games (such as the core and the Shapley value) and non-cooperative

games (such as Nash equilibria and dominant strategies). They have gained a good understanding of these concepts and are able to analyze concrete games by using them.

Teaching and Learning Methods:
Lectures introduce basic knowledge; tutorials practice modelling of application problems as games and applying solution concepts to concrete examples.

Media:
Lectures given as presentations (projector and/oder blackboard), tutorials with group work and exercise sheets

Reading List:
Einführung in die Spieltheorie, 8. Auflage, Springer Gabler, 2019.
Steven Tadelis - Game Theory: An Introduction, Princeton University Press, 2013.
M. J. Osborne and A. Rubinstein - A Course in Game Theory, MIT Press, 1994

Responsible for Module:
Prof. Clemens Thielen

Courses (Type of course, Weekly hours per semester), Instructor:
Einführung in die Spieltheorie (Vorlesung mit integrierten Übungen, 4 SWS)
Thielen C [L], Thielen C
For further information in this module, please click campus.tum.de or here.

Module Description

CS0106: Introduction to Graphs and Networks | Einführung in Graphen und Netzwerke

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2019/20

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:
Assessment takes an oral form (25 minutes). Students show the extent to which they have understood the taught definitions and terminology from the field of graphs and networks. They show to which extend they are able to use networks in order to model problems from science and engineering. They are also expected to use appropriate methods to solve fundamental optimization problems on networks. Students demonstrate their understanding of these methods when answering comprehension questions.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Module Mathematics (WZ1601)

Content:
Directed and undirected graphs and networks, paths and cycles, connected components, minimum spanning tree problem, shortest path problem, Prim's algorithm, Kruskal's algorithm, Dijkstra's algorithm, matchings, Modeling with graphs and networks

Intended Learning Outcomes:
Students have aquired basic theoretical and practical knowledge in the field of graphs and networks. They know the basic definitions and terminology and are able to use networks in order to model problems from science and engineering. Students know fundamental optimization problems on networks such as the minimum spanning tree problem or the shortest path problem as well as the most important methods for solving these problems. They have gained a good understanding

of these methods, can choose appropriate methods among them, and can apply these to case examples.

Teaching and Learning Methods:
Lectures introduce basic knowledge; tutorials practice modelling using networks and the application of methods for solving optimization problems on networks.

Media:
Lectures given as presentations (projector and/oder blackboard), tutorials with group work and exercise sheets

Reading List:
André Krischke und Helge Röpke - Graphen und Netzwerktheorie, Carl Hanser Verlag, 2015.
Sven Krumke und Hartmut Noltemeier - Graphentheoretische Konzepte und Algorithmen, 3. Auflage, Vieweg+Teubner Verlag, 2012.
Ravindra Ahuja, Thomas Magnanti, James Orlin - Network Flows, Prentice Hall, 1993.

Responsible for Module:
Prof. Clemens Thielen

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

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

Module Description

WZ1947: Electrochemistry | Elektrochemie

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

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:
The learning results are proved in form of a written test (60 min exam duration). Based on questions to electrochemical aspects the students prove that they know the corresponding technical terms, designations and contents, that they have understand the basic relations and are able to apply their knowledge concerning the reactions taking place within the scope of kinetic and thermodynamic connections. For that purpose concrete computational tasks are assigned.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
General Chemistry and Physical Chemistry, Mathematics, Physics

Content:
- Principles of Electrochemistry: Electrochemical thermodynamics (electrochemical potential, electrode potential, half-cell), transport in solution (migration, diffusion, convection), thermodynamics of interface (electrical double layer), electrochemical kinetics.
- Stationary Electrode Voltammetry (Potential pulse, linear sweep and cyclic voltammetry at macro- and microelectrodes) for determination of thermodynamic and kinetic parameters. Determination of reaction mechanism and catalytic cycle;
- Mass transport by convection (Rotating disc electrode and rotating ring/disk electrode, thin film methodology, ultra-micro electrodes, flow-cell electrodes.
- Electrochemical Impedance Spectroscopy (general principles, data acquisition and modelling, data analysis and interpretation).
- Implementations of electrochemistry (Renewable energy conversion, green electrosynthesis, sustainable use of resources)

Intended Learning Outcomes:
The students obtain basic knowledge about fundamental of electrochemistry and electroanalytical methods. They handle principles in the field of electrochemistry and can apply these to simple problems related to electrochemical systems. In particular they understand the general interplays between, electron transfer, reactions, mass transport and their respective time scale defining the overall electrochemical response. Furthermore, the students are familiar with the electrochemical processes relevant in industry, renewable energy conversion, green electrosynthesis and sustainable management of resources, and can apply their theoretical knowledge to these processes. In addition they know different analytical methods in electrochemistry and even actual examples of use for designing and optimizing these processes in research and industry.

Teaching and Learning Methods:
In the lecture the teaching content is imparted by speech of the lecturer using powerpoint presentations and blackboard sketches.

Media:
Presentations, PowerPoint, script

Reading List:
Elektrochemie, Hamann/Vielstich, ISBN: 3527310681
Electrochemical Methods: Fundamentals and Applications; Bard/Faulkner, ISBN-13: 978-0471043720

Responsible for Module:
Prof. Nicolas Plumeré

Courses (Type of course, Weekly hours per semester), Instructor:
Elektrochemie (Übung) (Übung, 1 SWS)
Plumeré N [L], Höfer T, Plumeré N

Elektrochemie (Vorlesung) (Vorlesung, 2 SWS)
Plumeré N [L], Höfer T, Plumeré N
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1632: Basics on renewables utilization | Grundlagen der stofflichen Biomassenutzung

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: summerterm 2019

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:
Assessment takes a written examination (60 minutes), with students recall structure, transformation and use of different renewable resources. Students are required to answer questions using individual formulations and outline structures and reactions. In addition, sample calculations are to be worked out.

Repeat Examination:
Next semester

(Recommended) Prerequisites:

Content:
Introduction to various kinds of constituents of renewable resources: sugars, polysaccharides, fatty acids and oils, amino acids, proteins, terpenes, aromatics. Their structure, composition, distribution, characteristics, analytics and kind of added value, as well as their use will be introduced.

Intended Learning Outcomes:
After completion of the modules, students understand the chemical composition of renewable resources as well as their production and application. Using this knowledge students are able to explain the respective advantages and disadvantages as well as analyze the underlying physical, chemical and biotechnological principles of their conversion into valuable products.

Teaching and Learning Methods:
In the lecture the teaching content is imparted by speech of the lecturer using powerpoint presentations and case studies. Corresponding to the teaching content exercise sheets are prepared on which the students work in self-study. The solution and discussion of the exercises takes place in the tutorial.

Media:
Presentation, script, examples and solutions

Reading List:
script, sample solutions for exercises

Responsible for Module:
Rühmann, Broder; Dr. rer. nat.

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

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

Module Description

WZ1689: Basics of Numerical Methods and Simulation | Grundlagen Numerik und Simulation [NumS]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: summerterm 2020

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 achievement shall be done in the form of a written test. As an aid the materials (lecture slides, example programs) used during the lecture may be employed. The students show by solving programming tasks that they know the basics of Matlab and are able to implement simple numerical methods. By using case studies they apply methods to specific technical problems.
Exam duration: 90 minutes

Repeat Examination:
Next semester

(Recommended) Prerequisites:
WZ1600 Physics, WZ1601 Mathematics

Content:
'- Basics of programming by Matlab/Simulink
- simple numerical methods: Equation systems, integration, differentiation, zero search
- numerical solution of differential equations
- application of methods by using case studies (e.g. mechanical and electric systems)

Intended Learning Outcomes:
After having participated in the module units the students know the basics of handling Matlab/ Simulink and simple methods of numerical mathematics. For the treated case studies they are able to independently implement these methods in Matlab programmes and thus find solutions to problems and assess the solution found.

Teaching and Learning Methods:
The module consists of one lecture and an associated session of exercises. Contents of the lecture shall be imparted in a speech and deepened through independent preparation of exercises by the students. Processing of exercises is often done by independent preparation of programming tasks.

Media:
Presentations, writing on the board, demonstration of programmes/scripts

Reading List:

Responsible for Module:
Kainz, Josef; 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

WZ1978: Green Chemistry | Grüne Chemie

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2018/19

Module Level: Bachelor	**Language:** German/English	**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:
The achievement of the learning outcomes will be tested in a written exam and in a seminar. The students are expected to be able to reproduce the course contents correctly and transfer them to different contexts in written form.
The written exam has a duration of 90 minutes. Aids are not permitted. In addition, the contents of the course will be enhanced in a seminar. The proportion of the written exam to the module grade is 80 %. In the seminar, students analyze selected case studies from current literature in the context of Green Chemistry with respect to their sustainability and present these to their co-students and instructor in an oral presentation with short discussion and a brief written composition. The proportion of the seminar grade to the module grade is 20 %.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basics of chemistry, physics and biology

Content:
The module contains an introduction to the basics of environment-friendly 'green' synthesis routes for chemical products. The 12 basic principles of 'green engineering' will be covered. Sustainably production and treatment, process optimizations and innovative technological approaches and optimized separation methods will be discussed. The different processes will be presented with respect to relevant environment aspects, sustainability and energy- as well as raw materials consumption.

Intended Learning Outcomes:
After completion of the module, the students are able to describe the basic principles of environment-friendly and sustainable production of chemicals and demonstrate them at the examples of selected process chains. They can determine and present specific resource requirements with respect to energy, raw- and auxiliary materials as well as the yields during production, emissions into air, water and soil, as well as amounts of wastewater and solid waste. They are alse able to couple syntheses to preceding and subsequent processing steps. Thus, they can assess the sustainabilities of production processes autonomously.

Teaching and Learning Methods:
Lecture with blackboard and slide presentations for the development of technical concepts. Seminar with written tests. Self-study is essential to consolidate the course contents.

Media:
Lecture, blackboard, slides, group work

Reading List:
Jiménez-González, Constable, Green Chemistry and Engineering, Wiley-VCH, 2010

Responsible for Module:
Zollfrank, Cordt; Prof. Dr. rer. silv.

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung
Grüne Chemie
2SWS

Seminar
Grüne Chemie
1SWS
Cordt Zollfrank
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1945: Catalysis | Katalyse

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2019/20

Module Level: Bachelor	**Language:** German/English	**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:
The learning results are assayed by a written test (60 min) in which the students have to reflect basic aspects of catalysis as well as the mechanistic involvement of catalysts by means of examples. Futhermore the students show by means of arithmetic problems which are assigned that they are able to quantify simple examples.

Repeat Examination:
Next semester

(Recommended) Prerequisites:

Content:
Homogenous/heterogenous catalysis, mechanistic details of activation at transition metal centers, characterisation of catalysts, mass and heat transport at the catalyst, catalytic reactors

Intended Learning Outcomes:
Students can explain crucial chemical aspects of catalysis in simple examples. They can identify the mechanistic details of catalysis during a total reaction equation. By calculations they can quantify the implication of the catalyst in characteristic numbers.

Teaching and Learning Methods:
In oral presentations, basic facts of catalysis are presented. In about 5 simple experiments done by students in small groups, quantitative results are obtained, and students themselves calculate the respective characteristic numbers.

Media:
Practical course script, PowerPoint presentations, blackboard sketch, lab, lab equipment

Reading List:
Practical course script

Responsible for Module:
Riepl, Herbert; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Katalyse (Übung) (Übung, 1 SWS)
Riepl H [L], Riepl H

Katalyse (Vorlesung) (Vorlesung, 2 SWS)
Riepl H [L], Riepl H
For further information in this module, please click campus.tum.de or here.

Module Description

CS0084: Regulation of Microbial Metabolism | Mikrobielle Stoffwechselregulation [MicriobReg]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: summerterm 2019

Module Level: Bachelor	**Language:** German/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 learning results are to be proved in form of a written test (60 min). The students demonstrate that they know relevant mechanisms of metabolic regulation and that they have understood the basic connections of microbial metabolism and its regulation dealt with in the module and can apply and transfer the methods and techniques.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Fundamentals of Microbiology and Molecular Biology from the Bachelor's courses

Content:
Relevant topics of metabolic regulation: i.a. catabolite repression, attenuation, autogenous regulation, endproduct inhibition, 2-component systems, quorum sensing, regulatory RNAs, stringent control, nitrogen regulation, iron homeostasis, phosphate regulation

Intended Learning Outcomes:
Upon successful completion of the module, students will be familiar with the principles and relevant mechanisms metabolic regulation. In addition, students are able to transfer the knowledge they have acquired in order to develop solutions to new problems.

Teaching and Learning Methods:
The contents of the lectures are conveyed by a talk of the lecturer, based on ppt-presentations.The blackboard might additionally be used to explain more complex relationships. To a limited extent,

this can be supplemented by self-study of the literature mentioned in the lecture. Learning methods: During the follow-up of the lecture, the students intensively deal with the teaching contents of the lecture.

Media:
PowerPoint, whiteboard

Reading List:

Responsible for Module:
Bastian Blombach

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

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

Module Description

WZ1694: Applied Methods in Chemistry | Praktische Methoden in der Chemie

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2016/17

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter/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:
Exam achievement shall be done in form of a laboratory performance (e.g. preparation, performance and written evaluation) combined with a ten-minute presentation. Thus it shall be demonstrated that the working methods learned can be applied practically and transferred to the execution of test series. By means of the presentation communicative competence shall be verified when scientific topics are presented in front of an audience. Laboratory performance shall be evaluated with 2/3, the presentation with 1/3.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Knowledge and laboratory experience like in the modules of WZ1680 (LV3641: Basics of general and organic chemistry) and WZ1681 (LV968 Organic Chemistry and LV981 Organic Chemistry Practical Course shall be imparted.

Content:
The module makes use of different methods leading to the performance of test series. As a first step the students shall be lead to planning and performance of basic activities of laboratory practice by means of the lecture including thematisation of experiment design and research of literature as well as keeping the laboratory journal, how to use the most important and basic practical working methods as well as handling the most import laboratory equipment. In the next step the different working methods (including weighing, dissolving, diluting) shall be applied in supervised practical exercises. Subsequently individual test series shall be planned, processed and evaluated by the students after consultation with the lecturer.

Intended Learning Outcomes:
After having participated in the module units the students are capable of using basic working techniques (such as weighing, pipetting, dissolving, diluting) in the laboratory, of outlining simple test series, of performing an experimental design and of recognizing possible sources of errors.

Teaching and Learning Methods:
The module is successively built up using lecture, practical exercises and test series. In the lectures it is dealt with basic issues and methods necessary for the execution of subsequent exercises. After testing different methods in supervised exercises these methods will be transferred to a test series. Planning, performance and result evaluation will be summarised in a written assessment.

Media:
PowerPoint, Laboratory

Reading List:
Organikum, Lehrbuch der analytischen und präparativen anorganischen Chemie (Organikum, Textbook of Analytical and Preparative Anorganic Chemistry) (ISBN 978-3527339686) ; 1x1 der Laborpraxis (Basics of Laboratory Practice (ISBN 978-3527316571)

Responsible for Module:
Corinna Uramnn (corinna.urmann@tum.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Praktische Methoden in der Chemie (Übung) (Übung, 3 SWS)
Urmann C

Praktische Methoden in der Chemie (Praktikum) (Praktikum, ,5 SWS)
Urmann C

Praktische Methoden in der Chemie (Vorlesung) (Vorlesung, ,5 SWS)
Urmann C [L], Urmann C
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1949: Protein chemistry | Protein chemistry [PC]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: summerterm 2020

Module Level: Bachelor	**Language:** German/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 learning results are proved in form of a written test (60 min exam duration). Based on questions to synthesis, purification, modification, analytics, characterisation and implementation of proteins the students prove that they know the corresponding technical terms, designations and contents, that they have understand the basic relations and are able to apply their knowledge. During the examination the tasks are set in both languages and the processing of the examination tasks can take place either in German or English.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Successful participation in the modules "Biochemistry" and "Practical course Biochemistry".

Content:
Basic principles of protein chemisty, chemical and biochemical protein synthesis, protein folding, amino acid analysis, posttranslational modifications, protein sequencing, prediction of secondary structures, tertiary structures, pI, determination of sulfylhydryl and disulfide groups, desalinisation, protein data bases, methods for protein immobilisation and labeling

Intended Learning Outcomes:
After sucessful completion of the module the students are able to describe and explain basic concepts, phenomenons and relations in the field of protein chemistry. The students can describe biological and chemical methods of protein synthesis, purification and modification of proteins and know how proteins can be characterised. In addition they can describe the impact of modifications on the protein structure or activity and apply their theoretical knowledge by means of questions.

Teaching and Learning Methods:
In the lecture the teaching content is imparted by speech of the lecturer using powerpoint presentations and blackboard sketches. Corresponding to the teaching content exercise sheets are prepared on which the students work in self-study. The solution and discussion of the exercises takes place in the tutorial.

Media:
Presentations, PowerPoint, script, exercise sheets

Reading List:
Bioanalytik, F. Lottspeich, H. Zorbas, Spektrum Akademischer Verlag
Voet, D. , Voet, J.G., Biochemistry 4th Edition, Wiley-VCH, 2011; Nelson, D.L, Cox, M.M., Lehninger Principles of Biochemistry 5th Edition, WH Freeman, 2008; Berg, J.M, Tymoczko, J.L., Stryer, L., Biochemistry 6th Edition, 2006

Responsible for Module:
Sieber, Volker; Prof. Dr. rer. nat.

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

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

Module Description

WZ1954: Fluid mechanics | Strömungsmechanik

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

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:
The module will be assessed by a written examination. Students calculate tasks of fluidmechanics based on its fundamental equations. In addition, the unterstanding of content is tested by the explanation of theoretical operations. Dimensionless numbers to evaluate complex task are applied and explained. Altogether the students show that they can solve known tasks from the fluid mechanics area and transfer their acquired knowledge to new assignments of tasks. Exam duration: 90 minutes.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge of the most important physical correlations (basic parameters with units, definition of pressure, temperature etc.) must be available. Besides formation and solution of systems of equations as well as command of simple integral and differential calculus as well as Physics and Mathematics is a requirement.

Content:
This module provides basics of fluid mechanics, that are relevant for further engineering applications . Therefore the theoretical fundamentals are derived and deepened throug illustrating examples . The content will cover the following topics: hydrostatics, fluid dynamics (Bernoulli , Navier-Stokes , flow resistance), CFD.

Intended Learning Outcomes:
After participating in the module, students are able to understand and analyze simple tasks regarding flows, to apply the methods for their solution and to give a mathematical solution. In

particular the students can transfer the learned methodology and the obtained results to new assignments of tasks.

Teaching and Learning Methods:
The module consists of a lecture during which also exercises will be performed alternately. Contents of the lecture shall be imparted in speech and by presentation. To deepen their knowledge students shall be encouraged to study the literature and examine with regards to content the topics. In the exercises performed as part of the module learned theory shall directly be applied with a practical orientation by means of arithmetic examples.

Media:
Presentations, slide scripts, exercises

Reading List:
Siekmann, Thamsen: Strömungslehre, 2. Auflage, Springer
Örtel: Strömungsmechanik für Ingenieure und Naturwissenschaftler, 7. Auflage, Springer
[226] Baehr, Hans Dieter; Kabelac, Stephan: Thermodynamik, 14. Auflage, Springer, ISBN 978-3-642-00555-8, 2009
[242] VDI Wärmeatlas, VDI-Gesellschaft Verfahrenstechnik und Chemie-Ingenieurwesen 9.Auflage, Springer-Verlag ISBN 3-540-41201-8 9.Auflage

Responsible for Module:
Gaderer, Matthias; Prof. Dr.-Ing.

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung
Strömungsmechanik
2 SWS

Übung
Strömungsmechanik
2 SWS
Matthias Gaderer, Bastian Alt
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1952: Systems Biology | Systembiologie [SysBio]

= Combination of the modules WZ1951 Computational Biology and Functional Genomics and WZ1948 Methods of Systems biology

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2018/19

Module Level: Bachelor	**Language:** German/English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 8	**Total Hours:** 240	**Self-study Hours:** 150	**Contact Hours:** 90

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

Description of Examination Method:
The examination consists of a written examination (150 min) in which the students prove on the one hand that they are able to apply the bioinformatic methods and algorithms imparted by the module and to select and apply independently for each question a suitable bioinformatic process. Based on questions to definitions and methods of systems biology the students prove on the other hand that they know the corresponding technical terms, designations and contents, that they have understand the basic relations and are able to apply their knowledge. A bonus of 0,3 is credited on the grade of this written examination when during the module at least 65% of the exercise sheets are handed in and are marked with a positive result (an increase of the grade from 4,3 to 4,0 is not possible). Thereby students shall be motivated to participate in the tutorial which is very important for them.

Repeat Examination:
Next semester

(Recommended) Prerequisites:

Content:
The lecture provides a fundamental overview of Systems Biology, which includes all relevant analytical methods (omics-technologies). This will include the effect of targeted approaches on the wholitic cell system. Additionally, selected bioinformatic methodologies, which are relevant in the scientific research field, especially in the realm of statistical genetics, genome-wide association

studies, analysis of complex biological networks and state-of-the-art methods in the area of machine learning for genomic data will be examined.

Intended Learning Outcomes:
The students acquire detailed and differentiated knowledge about concepts and definitions of Systems biology. Especially the different omics technologies will be highlighted which mainly defines the approach of systems biology. The students acquire detailed and differentiated knowledge about bioinformatic methods and algorithms to handle complex bioinformatic problems. The students are able to deduce an appropriate bioinformatic research design to investigate selected research questions and to interpret the results.

Teaching and Learning Methods:
The lecture will be performed as ex-cathedra teaching to provide the students will all necessary fundamentals which they will need for insights in the different cellular systems and basic data analysis of the different omics technologies will be applied. The contents mediated by the lecture are outlined in the tutorial by means of concrete bioinformatic research questions. The bioinformatic methods and algorithms which are presented in the lecture are proved and applied for concrete problems self-contained at the computer and accompanied by recording the scientific proceeding as a written report.

Media:
PowerPoint presentations and blackboard. During the exercise the students work independently on PCs to apply the learnt methods on various case-studies.

Reading List:
Bioinformatics and Functional Genomics, Jonathan Pevsner, 2017

Responsible for Module:
Dominik Grimm (dominik.grimm@tum.de)

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

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

Module Description

WZ1937: Technical Thermodynamics | Technische Thermodynamik [TTD]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

Module Level:	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:
Exam achievement shall be done in the form of a written test. The students calculate thermodynamic and thermotechnical tasks, state variables, efficiencies of thermodynamic systems and heat transfers. They show that they are able to outline and explain cyclic processes. They demonstrate that they are able to mathematically and systematically solve questions on the fundamentals of thermodynamics and heat transfer. Exam duration: 120 minutes

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge of the most important physical correlations (basic parameters with units, definition of pressure, temperature etc.) must be available. Besides formation and solution of systems of equations as well as command of simple integral and differential calculus is a requirement.
Physics WZ1600, Mathematics WZ1601

Content:
In this module thermodynamic fundamental concepts such as open and closed system, enthalpy, first and second laws, energy balancing, state variables and the most important changes of state (isobaric, isochoric, isothermal, isentropic, polytropic) shall be explained as well as different cyclic processes. Application of the T-s, h-s and t-Q diagrams shall be illustrated.
An introduction is given to heat transfer (conduction, convection, radiation). Moist air, h-x diagram, energy and material balancing of chemical processes and combustion calculation as well as calculation of heat of combustion shall be represented. Application of the theory to a series of technical plants shall be imparted (e. g. steam turbine, gas turbine, boiler, heat pump).

Intended Learning Outcomes:
After having participated in the module the students are capable of understanding thermodynamic systems and fundamental concepts. They are able to apply first and second laws of thermodynamics and are thereby be able to explain functioning of thermal engines.

Teaching and Learning Methods:
The module consists of a lecture during which also exercises will be performed alternately. Contents of the lecture shall be imparted in speech and by presentation. To deepen their knowledge students shall be encouraged to study the literature and examine with regards to content the topics. In the exercises performed as part of the module learned theory shall directly be applied with a practical orientation by means of arithmetic examples.

Media:
Presentations, slide scripts, exercises

Reading List:
[223] Pischinger, R.; Klell, M.; Theodor, S.: Thermodynamik der Verbrennungskraftmaschine, 3. Auflage, Springer-Verlag, ISBN 978-3211-99279-0, 2009
[224] Stephan, P.; Schaber, K.; Stephan, K.; Mayinger, F.: Thermodynamik, Band 1: Einstoffsysteme, 17. Auflage, Springer, ISBN 978-3-540-70813, 2006
[226] Baehr, Hans Dieter; Kabelac, Stephan: Thermodynamik, 14. Auflage, Springer, ISBN 978-3-642-00555-8, 2009
[] Wärme- und Stoffübertragung, Hans Dieter Baehr und Karl Stephan, Springer, ISBN 978-3-642-36558-4 , 2013
[227] HSC Chemistry, Outokumpu Research Oy, Pori, Finnland, A. Roine, Ver. 1.10, 1990
[233] Stephan, P.; Schaber, K.; Stephan, K.; Mayinger, F.: Thermodynamik Grundlagen und technische Anwendungen, Band 2: Mehrstoffsysteme und chemische Reaktionen, 15. Auflage, Springer, ISBN 978-3-540-36709-3, 2010
[234] Gmehlin, J.; Kolbe, B.: Thermodynamik, 2. Auflge, VCH, ISBN 3-527-28547-4, 1992
[235] Atkins, Peter W.: Physikalische Chemie, VCH, ISBN 3-527-25913-9, 1990
[237] Schnitzer, H.: Grundlagen der Stoff- und Energiebilanzierung, 9. Auflage, Vieweg, ISBN 3-528-04794-1, 1991
[268] GTT-Technologies; Programm Factsage 6.3, http://www.gtt-technologies.de
[242] VDI Wärmeatlas, VDI-Gesellschaft Verfahrenstechnik und Chemie-Ingenieurwesen 9.Auflage, Springer-Verlag ISBN 3-540-41201-8 9.Auflage

Responsible for Module:
Gaderer, Matthias; Prof. Dr.-Ing.

Courses (Type of course, Weekly hours per semester), Instructor:
Technische Thermodynamik / Thermodynamik & Wärmelehre (Übung) (Übung, 2 SWS)
Gaderer M [L], Gaderer M

Technische Thermodynamik / Thermodynamik & Wärmelehre (Vorlesung) (Vorlesung, 2 SWS)

Gaderer M [L], Gaderer M, Tilk G
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1955: Heat transfer | Wärmeübertragung

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2018/19

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:
Exam achievement shall be done in the form of a written test. The students calculate heat transfer tasks. They are able to explain dimensionless quantities and apply them in arithmetic examples. They explain and calculate different mechanisms of heat transfer. Altogether the students show that they are able to understand and solve assignments of tasks from the heat transfer area.
Exam duration: 90 minutes.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge of the most important physical correlations (basic parameters with units, definition of pressure, temperature etc.) must be available. Besides formation and solution of systems of equations as well as command of simple integral and differential calculus is a requirement.
Physics, Mathematics and Thermodynamics

Content:
In this module knowledge in heat transfer gained from the lecture of Technical Thermodynamics (TTD) shall be extended, deepened computation bases are created and dimensionless numbers are deduced. Topics will be: heat conduction, covection, heat radiation, heat transfer through objects, calculations based on Nusselt and Prandtl number, dimensioning and calculation of heat exchangers, transient heat conduction, influence of phase changes and knowledge transfer on parallel issues in mass transfer.

Intended Learning Outcomes:
After having participated in the module the students are capable of understanding and analysing simple tasks relating to heat transfer (convection, conduction, radiation). Additionaly the student will be able to apply methods to solve problems concerning heat transfer systems.

Teaching and Learning Methods:
The module consists of a lecture during which also exercises will be performed alternately. Contents of the lecture shall be imparted in speech and by presentation. To deepen their knowledge students shall be encouraged to study the literature and examine with regards to content the topics. In the exercises performed as part of the module learned theory shall directly be applied with a practical orientation by means of arithmetic examples. Thus for instance the construction of a heat exchanger is outlined.

Media:
Presentations, slide scripts, exercises

Reading List:
[224] Stephan, P.; Schaber, K.; Stephan, K.; Mayinger, F.: Thermodynamik, Band 1: Einstoffsysteme, 17. Auflage, Springer, ISBN 978-3-540-70813, 2006
[226] Baehr, Hans Dieter; Kabelac, Stephan: Thermodynamik, 14. Auflage, Springer, ISBN 978-3-642-00555-8, 2009
[] Wärme- und Stoffübertragung, Hans Dieter Baehr und Karl Stephan, Springer, ISBN 978-3-642-36558-4 , 2013
[227] HSC Chemistry, Outokumpu Research Oy, Pori, Finnland, A. Roine, Ver. 1.10, 1990
[233] Stephan, P.; Schaber, K.; Stephan, K.; Mayinger, F.: Thermodynamik Grundlagen und technische Anwendungen, Band 2: Mehrstoffsysteme und chemische Reaktionen, 15. Auflage, Springer, ISBN 978-3-540-36709-3, 2010
[234] Gmehlin, J.; Kolbe, B.: Thermodynamik, 2. Auflge, VCH, ISBN 3-527-28547-4, 1992
[235] Atkins, Peter W.: Physikalische Chemie, VCH, ISBN 3-527-25913-9, 1990
[268] GTT-Technologies; Programm Factsage 6.3, http://www.gtt-technologies.de
[242] VDI Wärmeatlas, VDI-Gesellschaft Verfahrenstechnik und Chemie-Ingenieurwesen 9.Auflage, Springer-Verlag ISBN 3-540-41201-8 9.Auflage

Responsible for Module:
Matthias Gaderer (gaderer@tum.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Wärmeübertragung / WSSP / Wärmelehre (Übung) (Übung, 2 SWS)
Gaderer M [L], Gaderer M, Klüh D

Wärmeübertragung / WSSP / Wärmelehre (Vorlesung) (Vorlesung, 2 SWS)
Gaderer M [L], Gaderer M, Klüh D
For further information in this module, please click campus.tum.de or here.

Module Description

CS0033: Accredited Module 3 ECTS | Anerkanntes Modul 3 ECTS

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2018/19

Module Level:	Language:	Duration:	Frequency:
Credits:* 3	**Total Hours:**	**Self-study Hours:**	**Contact Hours:**

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

Description of Examination Method:

Repeat Examination:

(Recommended) Prerequisites:

Content:

Intended Learning Outcomes:

Teaching and Learning Methods:

Media:

Reading List:

Responsible for Module:

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

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

Module Description

CS0034: Accredited Module 5 ECTS | Anerkanntes Modul 5 ECTS

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2018/19

Module Level:	Language:	Duration:	Frequency:
Credits:* 5	**Total Hours:**	**Self-study Hours:**	**Contact Hours:**

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

Description of Examination Method:

Repeat Examination:

(Recommended) Prerequisites:

Content:

Intended Learning Outcomes:

Teaching and Learning Methods:

Media:

Reading List:

Responsible for Module:

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

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

Module Description

CS0180: Concepts of Physics and Chemistry in Nature | Konzepte der Physik und Chemie in der Natur

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2020/21

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 performance test will be in the form of a written examination. The students should demonstrate in the exam the understanding of the physicochemical principles governing natural systems. They will be asked about
Basic concepts of physical chemistry applied to energy conversion in natural systems and to the structure of biomolecules. No auxiliary means are allowed in the exam. 120 min examination time

Repeat Examination:
Next semester

(Recommended) Prerequisites:
This course will intend to consolidate basic concepts in Physics, Mechanics, Chemistry, and Mathematics having the focus on Nature examples. As such, basic knowledge in Physics, Chemistry, Mechanics, and Mathematics is required.

Content:
The module aims at providing in-depth knowledge to the students in the field of Physics and Chemistry applied to Biology. The focus on basic physical and chemical laws, concepts, principles and processes, including chemical bonding, chemical kinetics, spectroscopy, thermodynamics, thermochemistry, mechanics, optics, among others. The students will be able to apply them to understand the functionality of biological compounds/materials towards a more practical vision of Nature and its possible technological application.
The course will be divided into several topics related to the chemical structure of proteins, sugars, and other bio compounds, the formation of micro and macro self-assembled structures, light manipulation, heat management, mechanics, and electrical control. Each topic will be addressed

refreshing the most important physical and chemical concepts followed by their relevance in the structural and functional aspects of these materials and their possible application in technology.

Intended Learning Outcomes:
At the end of the module students will be able to analyse biological systems using a physicochemical perspective; describe the different ways energy is transformed and used by natural systems (thermally, optically, mechanical etc.). They will be able to analyse the structure of proteins and other biomolecules and to identify the forces that define their functionality. They will be able to apply these concepts to understand bio-based and bio-inspired technologies.

Teaching and Learning Methods:
This course attendance includes lectures and exercises. For this purpose, powerpoint presentns, practical training materials, and open discussion seminars will be used.

Media:
The following forms of media apply: Script, powerpoint, films, and blackboards.

Reading List:
1. Physical Chemistry for the Biological Sciences, 2nd Edition Gordon G. Hammes, Sharon Hammes-Schiffer, Wiley, 2015, ISBN: 978-1-118-85900-1
2. Physical Chemistry for the Life Sciences, 2ndEdition Peter Atkins and Julio De Paula Oxford University Press ISBN: 978-0-19-956428-6
3. Introduction to Biophotonics Paras N. Prasad Wiley 2003, ISBN: 0-471-28770-9.
4. Introduction to Biomechanics Duane Knudson Springer 2007 ISBN: 978-0-387-49311-4

Responsible for Module:
Prof. Rubén Costa

Courses (Type of course, Weekly hours per semester), Instructor:
Konzepte der Physik und Chemie in der Natur (Vorlesung) (Vorlesung, 2 SWS)
Costa Riquelme R [L], Costa Riquelme R, Fuenzalida Werner J

Konzepte der Physik und Chemie in der Natur (Übung) (Übung, 2 SWS)
Costa Riquelme R [L], Costa Riquelme R, Fuenzalida Werner J
For further information in this module, please click campus.tum.de or here.

Interdisciplinary Electives | Fachübergreifende Wahlmodule

Module Description

CH0136: Principles of Patent Law | Grundlagen des Patentrechts

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: summerterm 2018

Module Level: Bachelor/Master	**Language:** German	**Duration:** one semester	**Frequency:** summer semester
Credits:* 2	**Total Hours:** 60	**Self-study Hours:** 45	**Contact Hours:** 15

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

Description of Examination Method:
Die Prüfungsleistung wird in Form einer 90-minütigen schriftlichen Klausur erbracht. In dieser soll nachgewiesen werden, dass in begrenzter Zeit eine Fragestellung des Patentrechts richtig erkannt wird und Wege zu einer Lösung gefunden werden können. Beispielsweise können dies Fragen zum Ablauf einer korrekten Patentanmeldung oder die Bewertung von Erfindungen in patentrechtlichen Prüfungsverfahren sein. Die Antworten erfordern gegebenenfalls eigene Formulierungen.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Gute Deutschkenntnisse erforderlich. Englischkenntnisse sind nicht erforderlich, aber hilfreich.

Content:
Einführung in den gewerblichen Rechtsschutz und insbesondere das EPÜ-Patentsystem (Europäisches Patent). Das Modul vermittelt Grundkenntnisse im Hinblick auf Anmeldeerfordernisse, Patentierungsvoraussetzungen, Priorität, Prüfungsverfahren, Einspruch und Nichtigkeit, Beschwerde, Durchsetzung und Wirkungen von Patenten.

Intended Learning Outcomes:
Nach der Teilnahme am Modul "Grundlagen des Patentrechts" kennen die Studierenden die Abläufe im Patentsystem des EPÜ. Sie sind in der Lage, die patentrechtlichen Aspekte von

Erfindungen zu bewerten und wissen, wie die patentrechtlich richtige Vorgehensweise bei der Anmeldung von Patenten ist.

Teaching and Learning Methods:
Die Inhalte des Moduls werden in einer Vorlesung (1 SWS) durch Vortrag und Präsentation vermittelt. Ferner werden gemeinsam konkrete Fragestellungen beantwortet und ausgesuchte Beispiele bearbeitet, wodurch die Studierenden zur inhaltlichen Auseinandersetzung mit den Themen angeregt werden.

Media:
Präsentationen, Skript, Übungsaufgaben

Reading List:
-EPÜ in Auszügen
-Skript
-Broschüre "Der Weg zum Europäischen Patent" des Europäischen Patentamts

Responsible for Module:
Faktultät für Chemie

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

seit SoSe 2018 Dr. Stefanie Parchmann
seit WiSe 2017/18 Dr. Birte Bode
bis WiSe 2017/18 Dr. Angelika Schenk
For further information in this module, please click campus.tum.de or here.

Module Description

CS0033: Accredited Module 3 ECTS | Anerkanntes Modul 3 ECTS

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2018/19

Module Level:	Language:	Duration:	Frequency:
Credits:* 3	**Total Hours:**	**Self-study Hours:**	**Contact Hours:**

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

Description of Examination Method:

Repeat Examination:

(Recommended) Prerequisites:

Content:

Intended Learning Outcomes:

Teaching and Learning Methods:

Media:

Reading List:

Responsible for Module:

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

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

Module Description

CS0033-2: Accredited Module 3 ECTS | Anerkanntes Modul 3 ECTS

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: summerterm 2020

Module Level:	Language:	Duration:	Frequency:
Credits:* 3	**Total Hours:**	**Self-study Hours:**	**Contact Hours:**

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

Description of Examination Method:

Repeat Examination:

(Recommended) Prerequisites:

Content:

Intended Learning Outcomes:

Teaching and Learning Methods:

Media:

Reading List:

Responsible for Module:

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

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

Module Description

CS0034: Accredited Module 5 ECTS | Anerkanntes Modul 5 ECTS

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2018/19

Module Level:	Language:	Duration:	Frequency:
Credits:* 5	**Total Hours:**	**Self-study Hours:**	**Contact Hours:**

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

Description of Examination Method:

Repeat Examination:

(Recommended) Prerequisites:

Content:

Intended Learning Outcomes:

Teaching and Learning Methods:

Media:

Reading List:

Responsible for Module:

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

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

Module Description

CS0063: Microeconomics | Microeconomics [Micro I]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: summerterm 2019

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:
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. 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. A non-programmable calculator is allowed.

Repeat Examination:
Next semester

(Recommended) Prerequisites:

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.

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)

Responsible for Module:
Sebastian Goerg s.goerg@tum.de

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 (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

CS0069: Business 1 - Controlling and Supply Chain | BWL 1 - Controlling and Supply Chain [BWL 1]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: summerterm 2019

Module Level: Bachelor	**Language:** German/English	**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:
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 controlling as well as production and logistics planning in general. By means of exemplary objects from controlling and production or logistics planning the students demonstrate that they can interpret planning problems and connections between different problems and that they are able to interprete their results and apply the learnt instruments.

Repeat Examination:
Next semester

(Recommended) Prerequisites:

Content:
This module is an introductory module for business administration. The module introduces students to the basics and instruments of Controlling (focus on business administration and sustainability) and Supply Chain Management (focus on production and logistics). It covers the following
topics:

(1) Introduction into controlling
(a) Description of controlling functions, tools of operative and strategic controlling

(b) Identification and application of key performance indicators
(c) Planning and monitoring: Operative, tactical and strategic planning and monitoring
(d) Case examples especially in business adminstration, environmental management and corporate social responsibility (CSR)

(2) Introduction to Production and Logistics
(a) Explaining strategic planning problems (e.g., site location planning), tactical planning problems (e.g., infrastructure of production systems), and operational planning decisions (e.g., demand forecasting techniques)
(b) Introduction into the material requirements planning and production planning
(c) Approaches to transport logistics, material logistics, the design of the logistics network, and methods used at the procurement and distribution stage.

Intended Learning Outcomes:
After participating in this introductory module, students will be able to:
(1) to remember and understand the basic concepts, tasks and conception of controlling systems and coordination systems.
(2) to analyze problems concerning the coordination of planning and control in management systems.
(3) to apply the newly acquired knowledge to solve these problems.
(4) understand the relation between different planning problems in production and logistics.
(5) analyse specific planning problems of the strategic, tactical and operational level, as well as on how to apply respective solution approaches.
(6) explain essential managerial tasks in production and logistics planning.
(7) evaluate the economic impact of production and logistics related decisions.

Teaching and Learning Methods:
The module consists of two lectures, two exercises and voluntary tutorials. During the lectures the contents are delivered by presentations and
discussions. The lectures are used to convey the theorectical foundations and include conducting some exercises. The students are inspired to improve the acquired knowledge by studying the suggested literature. In the exercises and tutorials students apply the acquired knowledge in solving exercises and implementing case studies. Students deepen their understanding through working in small student groups as well as solving exercises on their own.

Media:
Presentations, text books, lecture notes, exercises, lecture notes

Reading List:
- Einführung in das Controlling, Weber/Schäffer, Schäffer-Poeschel, 13. Auflage;
- Günther, H.O., Tempelmeier, H. (2016), Produktion und Logistik, 9. Auflage, Springer
- Ghiani, G., Laporte, G., Musmanno R. (2013), Introduction to Logistics Systems Management, 2. Aufl., Wiley
Controlling, Horvàth, Vahlen Verlag, 13. Auflage;

- Globales Life Cycle Controlling, Stibbe, Springer Gabler Verlag, 1. Auflage;
- Corporate Social Responibility und wirtschaftliches Handeln, Bruton, Erich Schmidt Verlag, 1. Auflage

Responsible for Module:
Hubert Röder hubert.roeder@tum.de

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

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

Module Description

CS0085: Supply Chain Simulation | Supply Chain Simulation

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: summerterm 2019

Module Level: Bachelor	**Language:** German/English	**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:
Because of the mediation of competences and the interactive character of the module using the supply chain simulation „The Fresh Connection“ several group presentations are part of the evaluation:
- Introductory presentation for a supply chain topic (30 minutes / 50% of the evaluation)
- Short presentation concerning decision alternatives within a round of the simulation (10 minutes / 20% of the evaluation)
- Presentations of the decisions made within the respective rounds of the simulation, the lessons learnt and the results (15 minutes / 30% of the evaluation)

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Operations Research

Content:
The module is an innovative combination of mediation of theoretical background knowledge, practice and experience using the supply chain simulation „The Fresh Connection“. The topics in detail:
- Basics and decision making in supply chain management
- Supplier Management
- Demand Management
- Capacity and Production Management
- Inventory Management and Planning
- Supply Chain Mapping and component characteristics

- Supply Chain Strategy
- Variables and KPI‘s on strategic and tactical level
- External Collaboration

Intended Learning Outcomes:
The students will obtain a practice oriented overview of basics, decisions and interrelations in supply chain management. The students will achieve the ability to understand influencing factors and consequences of supply chain decisions with the help of the simulation “The Fresh Connection“. The students will achieve the competence for autonomous academic self study and application-oriented presentation of content. A focus of the mediation of competences is on work in cross-functional teams.

Teaching and Learning Methods:
Lecture, Web-based supply chain management simulation and learning environment, Self study and group work with presentation of result

Media:
Lecture, simulation software, presentations

Reading List:
Fisher, M.L. , What is the right supply chain for your product?, Harvard Business Review, March-April 1997
Christopher, M. , Logistics and Supply Chain Management, creating value-added networks, Prentice Hall, 2005
Chopra, S. and Meindl, Supply Chain Management, Pearson Education, third edition, 2007

Responsible for Module:
Alexander Hübner

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

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

Module Description

ED0180: Philosophy and Social Sciences of Technology | Philosophie und Sozialwissenschaft der Technik

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: summerterm 2011

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:
Prüfungsdauer (in min.): semesterbegleitende Online-Aufgaben.
Studienleistungen - Besuch der Vorlesung im Umfang von 2 SWS (2 SWS = 1 CP); - Lektüre von Texten (30 h = 1 CP); - Bearbeitung der drei Onlineaufgaben (30 h = 1 CP) Das Semester begeleitend werden drei schriftliche Aufgaben zu Teilabschnitten des Vorlesungsinhaltes gestellt, die individuell zu bearbeiten sind. Die Aufgabenstellung erfolgt online. Bearbeitungszeit ist jeweils 7 Tage. Die Ergebnisse der Online-Aufgaben werden über TUMonline bekannt gegeben. Die Prüfungsnote wird aus den Ergebnissen der drei Online-Aufgaben gebildet. Eine Wiederholung in Form einer mündlichen Prüfung ist möglich; Voraussetzung hierfür ist die vorangehende Beteiligung an den Online-Aufgaben. Bei Nichtbestehen der Nachprüfung ist das gesamte Modul zu wiederholen.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
keine

Content:
In dieser Vorlesung werden philosphische und sozialwissenschaftliche Perspektiven zur Betrachtung und Beurteilung von Technik erarbeitet. Es wird untersucht, welche politischen, soziologischen und ökonomischen Dimensionen moderner Technik unser Leben mitbestimmen und wie soziale
Faktoren in die Gestaltung von Technik eingehen.

Intended Learning Outcomes:
Ziel der Veranstaltung ist es, jenseits natur- und ingenieurwisenschaftlicher Spezialisierung ein umfassendes Bild von den Wirkungsformen und den meist nur stillschweigend mitgedachten, gesellschaftlichen Funktionsvoraussetzungen moderner Technik zu vermitteln.

Teaching and Learning Methods:
mit medialer Unterstützung

Media:
elektronische Vorlesungsskripte, Präsentationen

Reading List:
Je spezifisch zu den einzelnen Vorlesungswochen im Skript angegeben.

Responsible for Module:
Ulrich Wengenroth (ulrich.wengenroth@mytum.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

SZ0401: English - Basic English for Business and Technology - Domestic Module B2 | Englisch - Basic English for Business and Technology - Domestic Module B2

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2015/16

Module Level: Bachelor/Master	**Language:** English	**Duration:** one semester	**Frequency:**
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:
Assessement is based on: two written homework assignments for a total of 50% (based on multiple drafts to encourage learning by means of revision) in which students are able to produce clear, detailed text on a topic related to their fields of study and explain a viewpoint on a topical issue giving the advantages and disadvantages of various options; a presentation (including a handout and visual aids) 25% in which oral fluency is demonstrated and an ability to conduct technical discussions in their fields of specialization; a final written examination 25% which they demonstrate that they understand the main ideas of complex text in their field on both concrete and abstract topics, including technical discussions, and can express their opinions using a wide range of grammatical structures and collocations accurately. Dictionaries and other aids may not be used during the exam. Duration of the final examination: 60 minutes.

Repeat Examination:

(Recommended) Prerequisites:
Ability to begin work at the B2 level of the GER as evidenced score in the range of 40 – 60 percent on the placement test at www.moodle.tum.de. (Please check current announcements as the exact percentages may vary each semester.)

Content:
In this module verb forms such as present simple vs continuous, future forms, present perfect and past simple as well as conditionals will be reviewed and practiced. Other grammatical structures covered include: modal verbs of likelihood, comparatives and superlatives and uses of articles.

Oral and written communication skills needed in professional life will be introduced and practiced, as well as aspects of intercultural communication needed for achieving professional success. Emphasis is placed on developing strategies for continued learning.

Intended Learning Outcomes:
After completion of this module, students can understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in their fields of specialization; they can interact with a degree of fluency and spontaneity that makes regular interaction with native speakers quite possible without strain for either party; they can produce clear, detailed text on a wide range of subjects and explain a viewpoint on a topical issue giving the advantages and disadvantages of various options. Corresponds to B2 of the CER.

Teaching and Learning Methods:
Communicative and skills oriented treatment of topics with use of group discussion, case studies, presentations, writing workshops, listening exercises, and pair work encourage active use of language, as well as opportunities for feedback.

Media:
Textbook, online learning platform such as www.moodle.tum.de or Macmillan English Campus online resources (www.mec-3.com/tum), presentations, film viewings and audio practice.

Reading List:
Textbook to be announced in the course description. Handouts.

Responsible for Module:
Heidi Minning

Courses (Type of course, Weekly hours per semester), Instructor:
Englisch - Basic English for Business and Technology - Domestic Module B2 (Seminar, 2 SWS)
Hamzi-Schmidt E, O'Byrne S
For further information in this module, please click campus.tum.de or here.

Module Description

SZ04311: English - Basic English for Academic Purposes B2 | Englisch - Basic English for Academic Purposes B2

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2015/16

Module Level: Bachelor/Master	**Language:** English	**Duration:** one semester	**Frequency:**
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:
Assessement is based on: two written homework assignments for a total of 50% (based on multiple drafts to encourage learning by means of revision) in which students are able to produce clear, detailed text on a topic related to their fields of study and explain a viewpoint on a topical issue giving the advantages and disadvantages of various options; a presentation (including a handout and visual aids) 25% in which oral fluency is demonstrated and an ability to conduct technical discussions in their fields of specialization; a final written examination 25% which they demonstrate that they understand the main ideas of complex text in their field on both concrete and abstract topics, including technical discussions, and can express their opinions using a wide range of grammatical structures and collocations accurately. Dictionaries and other aids may not be used during the exam. Duration of the final examination: 60 minutes.

Repeat Examination:

(Recommended) Prerequisites:
Ability to begin work at the B2 level of the GER as evidenced score in the range of 40 – 60 percent on the placement test at www.moodle.tum.de. (Please check current announcements as the exact percentages may vary each semester.)

Content:
This course includes note-taking in lectures, practising tutorial participation, academic writing and presenting a topic on a related field of study. Common verb forms such as present simple vs continuous, future forms, present perfect and past simple as well as conditionals will be reviewed and practiced. Other grammatical structures covered include: modal verbs of likelihood,

comparatives and superlatives and uses of articles. Oral and written communication skills needed in academic life will be introduced and practiced, as well as aspects of intercultural communication needed for achieving professional success. Emphasis is placed on developing strategies for continued learning.

Intended Learning Outcomes:
On completion of this module students will have gained some of the study skills required for participating in an English-speaking academic environment. Students are able to produce some academic level work in degree courses held in English. They can understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in their fields of specialization; they can interact with a degree of fluency and spontaneity that makes regular interaction with native speakers quite possible without strain for either party; they can produce clear, detailed text on a wide range of subjects and explain a viewpoint on a topical issue giving the advantages and disadvantages of various options. Corresponds to B2 of the CER.

Teaching and Learning Methods:
This course involves practising study situations (participating in seminars, tutorials, note-taking in lectures), communicative and skills-oriented treatment of topics with use of group discussion, case studies, presentations, writing workshops, listening exercises, and pair work encourage active use of language, as well as opportunities for feedback.

Media:
Textbook, online learning platform such as www.moodle.tum.de or Macmillan English Campus online resources (www.mec-3.com/tum), presentations, film viewings and audio practice.

Reading List:
Textbook to be announced in the course description. Handouts.

Responsible for Module:
Heidi Minning

Courses (Type of course, Weekly hours per semester), Instructor:
Englisch - Basic English for Academic Purposes B2 (Seminar, 2 SWS)
Bhar A, Ritter J, Starck S
For further information in this module, please click campus.tum.de or here.

Module Description

SZ0488: English - Gateway to English Master's C1 | Englisch - Gateway to English Master's C1

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: summerterm 2016

Module Level: Bachelor/Master	**Language:** English	**Duration:** one semester	**Frequency:**
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:
Grades for an oral presentation (including a handout and visual aids 25%), multiple drafts of two homework assignments to allow students to develop written skills by means of a process of drafting and revising texts (50% total), and a final written examination (25%) contribute to the final course grade. Duration of the final examination: 60 minutes.

Repeat Examination:

(Recommended) Prerequisites:
C1 level according to the online placement test

Content:
This course includes note-taking in lectures, practising tutorial participation, academic writing and presenting a topic on a related field of study focusing on skills such as avoiding plagiarism, ethics, and formulating research questions.

Intended Learning Outcomes:
Upon finishing this course you will be able to follow lectures in English with little difficulty and summarize the main ideas. You will be sufficiently comfortable with English as to be able to write longer papers and critical essays in English, making use of general argumentation and rhetorical conventions.

Teaching and Learning Methods:
This course involves practising study situations (participating in seminars, tutorials, note-taking in lectures), pair-work & group-work in an English-speaking academic environment.

Media:
Internet, handouts, online material

Reading List:
n/a

Responsible for Module:
Heidi Minning

Courses (Type of course, Weekly hours per semester), Instructor:
Englisch - Controversial Topics in Science and Technology: Gateway to English Master's C1 (Seminar, 2 SWS)
Balton-Stier J, Bhar A, Jacobs R, Ritter J

Englisch - English for Academic Purposes: Gateway to English Master's C1 (Seminar, 2 SWS)
Bhar A, Clark R, Hamzi-Schmidt E, Schrier T, Starck S

Englisch - English for Geodesy: Gateway to English Master’s C1 (Seminar, 2 SWS)
Clark R

Englisch - English for Environmental Engineering: Gateway to English Master's C1 (Seminar, 2 SWS)
Clark R

Englisch - English for Civil Engineering: Gateway to English Master's C1 (Seminar, 2 SWS)
Clark R
For further information in this module, please click campus.tum.de or here.

Module Description

SZ1202: Spanish A2.1 | Spanisch A2.1

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2015/16

Module Level: Bachelor/Master	**Language:** Language taught	**Duration:** one semester	**Frequency:**
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:
Schriftliche Abschlussprüfung (keine Hilfsmittel erlaubt). Prüfungsdauer: 90 Minuten. In der schriftlichen Prüfung werden die in der Modulbeschreibung angegebenen Lernergebnisse geprüft. Sie beinhaltet Fragen zur Anwendung von Wortschatz und Grammatik, zu Lese- und Hörverstehen, sowie Aufgaben zur freien Textproduktion. Das Hörverstehen wird anhand von Hörbeispielen mit Hörverstehens-Fragen/-Fragebogen überprüft. Die Aufgabestellung einiger Prüfungsfragen fordert von den Studierenden in schriftlicher Form eine adäquate Reaktionsfähigkeit ähnlich wie in mündlichen Situationen.

Repeat Examination:

(Recommended) Prerequisites:
Gesicherte Kenntnisse der Stufe A1
Einstufungstest mit Ergebnis A2.1

Content:
In diesem Modul werden Grundkenntnisse in der Fremdsprache Spanisch vermittelt, die es den Studierenden ermöglichen, sich in alltäglichen Grundsituationen zurechtzufinden, z.B. auf Reisen, bei der Wohnungssuche, unter Kollegen, Freunden und Nachbarn, Austausch von Erfahrungen etc. Dabei werden interkulturelle und landeskundliche Aspekte berücksichtigt.
Die grammatikalischen Strukturen werden weiter aufgebaut, wie z.B. Verwendung von den Vergangenheiten Pretérito Perfecto - Pretérito Indefinido, ser und estar, unbetonte Personal Pronomen.
Es werden Strategien vermittelt, die mündlich wie schriftlich eine Verständigung trotz noch geringer Sprachkenntnisse ermöglichen.

Intended Learning Outcomes:
Dieses Modul orientiert sich am Niveau A2 "Elementare Sprachverwendung" der GER. Nach der Teilnahme an der Modulveranstaltung sind die Studierenden in der Lage die Bedeutung von kurzen, klaren und deutlich artikulierten Mitteilungen und Durchsagen zu erfassen. Die Kommunikation ist im Rahmen von einfachen, routinemäßigen Kontexten möglich. Der Austausch von Informationen erfolgt über kurze Dialoge mit verschiedenen Zeitbezügen (z.B.: Gegenwart, Vergangenheit, einfaches Futur) und umfasst einfache Satzgefüge mit beschränkten Strukturen zu vertrauten Tätigkeiten. Der/Die Studierende kann einfache Fragen zu Inhalten stellen und auch beantworten. Gespräche und Dialoge sind kurz, zeitlich beschränkt und orientieren sich inhaltlich an Kontexten, wie z.B. Familie, Freunde, Lebens- und Wohnraum, Reisen. Die Studierenden können kurze Texte oder Briefe lesen und verstehen, wenn diese einen häufig gebrauchten Wortschatz und bekannte Strukturen beinhaltet und wenn darin vertraute Informationen zu finden sind. Er/Sie ist in der Lage mithilfe feststehender Wendungen kurze, einfache Mitteilungen oder persönliche Briefe zu verfassen.

Teaching and Learning Methods:
Das Modul besteht aus einem Seminar, in dem die angestrebten Lerninhalte mit gezieltem Hör-, Lese-, Schreib- und Sprechübungen in Einzel-, Partner und Gruppenarbeit kommunikativ und handlungsorientiert erarbeitet werden. Durch die Kombination dieser Übungen wird die Interaktion mit den Partnern unterstützt und gefordert. Die Studierenden erwerben Teamkompetenz durch kooperatives Handeln in gemischten Gruppen.
Es werden Möglichkeiten aufgezeigt, den Lernprozess in der Fremdsprache Spanisch eigenverantwortlich und effektiver zu gestalten und damit die eigenen Lernfähigkeiten zu verbessern.
Durch kontrolliertes Selbstlernen grundlegender grammatischer Phänomene und Kommunikationsmuster in der Fremdsprache mit vorgegebenen (online-) Materialien werden die im Seminar vermittelten Grundlagen vertieft.
Freiwillige Hausaufgaben (zur Vor-und Nacharbeitung) festigen das Gelernte.

Media:
Lehrbuch; multimedial gestütztes Lehr- und Lernmaterial (Tafel, Folie, Übungsblätter, Bild, Film, etc.), auch online.

Reading List:
Lehrbuch (wird im Kurs bekanntgegeben)

Responsible for Module:
Maria Jesús García

Courses (Type of course, Weekly hours per semester), Instructor:
Spanisch A2.1 (Seminar, 2 SWS)
Barreda C, Galan Rodriguez F, Guerrero Madrid V, Hernandez Zarate M, Mayea von Rimscha A, Neumeier M, Rey Pereira C, Rodriguez Garcia M, Sosa Hernando E, Tapia Perez T
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1645: Communication and Presentation | Kommunikation und Präsentation

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: summerterm 2016

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:
In the course of the semester elaboration of presentations (individual and group presentations, role play, case processing in the group, video analyses) shall be expected (non-graded) as an exam achievement by the students. The module shall be terminated by a written test (90 min). In this exam the students shall convey different models from communications psychology without tools or illustrate them by using different mentioned scenarios.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
none

Content:
The module of Communication and Presentation is divided into the following fields:

• Basics of communications and communication methodology
• Communication rules nd their application in daily professional life
• Axioms of communications
• The four levels of communications ('four-ear-model')
• Communications in groups
• Giving and taking constructive feedback
• Do´s and Don´ts of communications
• Advantageous basic attitudes and communication techniques of non-directive conversation guidance

Intended Learning Outcomes:
After having participated in the module the students are able to understand basic communication models and allocate underlying theory to models accordingly.
Furthermore the students are able to describe communication by using case studies.
The four-level model of communications may be used in everyday life and in professional life.
When communicating in groups the students may give and take constructive feedback.

Teaching and Learning Methods:
During the lecture a speech (including discussion) will be worked out by the students. During the exercises role plays, case studies will be performed. In video analyses individual and group presentations shall be performed and analysed.

Media:
Presentations, script, video, exercise sheets, flipchart, powerpoint, showing films

Reading List:
Schulz von Thun, F. (2014). Miteinander reden 1: Störungen und Klärungen. Allgemeine Psychologie der Kommunikation. Hamburg: Rowohlt Verlag.
Schulz von Thun, F. (2014). Miteinander reden 2: Stile, Werte und Persönlichkeitsentwicklung. Differentielle Psychologie der Kommunikation. Hamburg: Rowohlt Verlag.
Schulz von Thun, F. (2014). Miteinander reden 3: Das "Innere Team" und situationsgerechte Kommunikation. Hamburg: Rowohlt Verlag.
Schulz von Thun, F. (2014). Miteinander reden 4: Fragen und Antworten. Hamburg: Rowohlt Verlag.

Responsible for Module:
Claudia Martin (martin.cm@t-online.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung
Kommunikation und Präsentation
2 SWS

Übung
Kommunikation und Präsentation
2 SWS
Claudia Martin
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1687: Introduction to Medicinal and Spice Plants (Exercise) | Einführung in die Heil- und Gewürzpflanzen [MSP]

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2015/16

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:
In an oral exam the students shall demonstrate that they recognize the most important medical and spice plants from the European area. As a non-graded academic performance a herbarium shall be set up in the course of the semester. They shall demonstrate that they are able to explain cultivation methods as well as harvest and drying. They shall be able to represent the ingredients of medical and spice plants and medical effect by using examples. Type of exam: orally, Exam Duration: 20 minutes

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Organic and Inorganic Chemistry, Botanics, Plant Production or Adaptation module Biology (WZ1110), Chemistry (WZ1106), Cultivation Systems (WZ1107)

Content:
Medicinal herbs history, presenting medical and spice plants, setting up of a herbarium, aspects of plant production for creating herb fields, their crop protection and harvest. Techniques for herb drying. Classes of agents such as terpenes, steroids, coumarins, alkaloids, vitamins, flavonoids. Connection between classes of agents and their medical effect. Basic mechanism of action of different classes of agents. Typical medicinal plants from European cultivated areas. Modern cultivation and use of medicinal plants in practice.

Intended Learning Outcomes:
After having participated in the module units the students are able to recognize medical and spice plants. They know basis of plant production for setting up a spice garden or fields. They know process technology basics for spice drying. They are able to designate the most important classes of agents. The students are able to call up connection between medical effect and chemical classes of agents by using typical examples. By having participated in the exercises in the spice garden and laboratory work they are able to use simple analytical-chemical activities relating to plant analysis or assess their results.

Teaching and Learning Methods:
Lecture, speech by teaching staff by using PP media, books and other written material, setting up of a herbarium, study trip to a herb drying company. Exercise (e.g. Experimentation of students under supervision). Excursion on research fields (LfL) in Manching. Determine Herbs in a garden.

Media:
PP presentations and printed versions as documents. Laboratory equipment for experimentation, ready-made exercise analyses. Herbs for a determination and view on etheric oils.

Reading List:
Deutschmann, F., Hohmann, B., Sprecher, E., Stahl, E., Pharmazeutische Biologie (Pharmaceutical Biology), 3 volumes, G. Fischer Verlag, 1992
Wendelberger, E., Heilpflanzen (Medicinal Plants): Erkennen | Sammeln | Anwenden (Recognising | Collecting | Using) (paperback – BLV Buchverlag Januar 2013

Responsible for Module:
Alexander Höldrich (alexander.hoeldrich@tum.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung
Einführung in die Heil- und Gewürzpflanzen
2 SWS
Übung
Einführung in die Heil- und Gewürzpflanzen
2 SWS
Alexander Höldrich (alexander.hoeldrich@tum.de)
Corinna Urmann (corinna.urmann@hswt.de)
Heidi Heuberger (heidi.heuberger@lfl.bayern.de)
For further information in this module, please click campus.tum.de or here.

Bachelor's Thesis | Bachelor's Thesis

Module Description

WZ1944: Bachelor's Thesis | Bachelor's Thesis

TUM Campus Straubing for Biotechnology and Sustainability (TUMCS)

Version of module description: winterterm 2017/18

Module Level: Bachelor	**Language:** German/English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 12	**Total Hours:** 360	**Self-study Hours:** 40	**Contact Hours:** 320

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

Description of Examination Method:
The module is completed with the preparation and positive evaluation of the Bachelor´s Thesis (depending on selection of topics 10 to 25 pages).

Repeat Examination:

(Recommended) Prerequisites:
120 Credits in compulsory and elective mdoules of the bachelor study course Chemical Biotechnology / Bioeconomy

Content:
consolidation of the knowledge of a specific biotechnological / bioeconomic topic which is arbitrary in consultation with the supervisor / consolidation of practical skills in the lab / presentation of a research-based topic in the field of biotechnology / Bioeconomy

Intended Learning Outcomes:
After completion of the module, the students are able to work self-reliant on simple scientific problems on the basis of scientific methods and analytical thinking. The can present their results in a conclusive way, are able to discuss and to draw conclusions.

Teaching and Learning Methods:
During the Bachelor´s Thesis, the students work on a scientific problem. At this juncture amongst others literature research as well as lab work and presentations are used. The actual teaching and

learning methods depend on the respective problem and have to be discussed with the supervisor for each single case.

Media:
Specialist literature, software and so on

Reading List:
in consultation with the supervisor

Responsible for Module:
Anja Faße (anja.fasse@hswt.de) Volker Sieber (sieber@tum.de)

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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