Module Catalog

M.Sc. Horticultural Science
TUM School of Life Sciences
Technische Universität München

www.tum.de/
www.wzw.tum.de/index.php?id=2&L=1

Module Catalog: General Information and Notes to the Reader

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

Notes to the reader:

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

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

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

Index of module handbook descriptions (SPO tree)

Alphabetical index can be found on page 295

Required Courses | Required Courses

Module Description

WZ1671: Crop Physiology: Growth and Development of Plants | Crop Physiology: Growth and Development of Plants [WZ1671]

Crop Physiology: Growth and Development of Plants

Version of module description: Gültig ab summerterm 2021

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

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

Description of Examination Method:
Aufgrund des Pandemiegeschehens hat der/die Studierende auch die Möglichkeit, an einer mündlichen Onlineprüfung (Aufsicht mit Zoom, 30 min.) teilzunehmen (Onlineprüfung: WZ1671o). Eine Präsenz-Prüfung wird zeitgleich parallel angeboten (WZ1671).

Students demonstrate their ability to understand the physiological processes affecting horticultural crop production and to evaluate limiting factors during the different growth stages of vegetable and ornamental cultures by answering comprehension questions and solving sample problems in a written examination (120 min). Furthermore, students will be tested for their ability to outline cultivation-specific and genetic approaches to improve qualitative and quantitative yield traits in horticultural crops. The use of learning aids during the examination is not allowed. Examination questions should be answered by writing self-formulated text.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge in genetics, plant physiology and plant production.

Content:
Flower formation, seed and fruit development. Physiology of vegetable crops as growth and development processes determining quality and yield of harvested products. Scientific basis of floricultural practice: Vegetative propagation; genetic/chemical/cultivation-dependent control of

branching; genetic/chemical/cultivation-dependent control of shoot growth; leaf/flower variegation; flower development in floricultural crops; physiology of flower color; postharvest physiology of cut flowers.

Intended Learning Outcomes:
Upon successful completion of this module, students are able:
- to understand the influence of environmental factors on major ontogenetic processes of vegetable crops such as flowering and the formation of the harvested products;
- to understand the underlying physiological principles of ornamental crop production methods including vegetative propagation, optimization of plant architecture and flower quality and improving longevity of ornamental crop products;
- to analyze growth conditions of important crop species to optimize yield;
- to evaluate molecular parameters affecting qualitative and quantitative yield traits in horticultural crops.

Teaching and Learning Methods:
The learning contents are presented as PowerPoint-supported lectures to impart the relevant theoretical background in plant physiology and to provide application-relevant examples in horticulture. In addition, class discussions of case studies from literature are conducted to deepen the knowledge in relevant topics.

Media:
Black board illustrations, presentation slides, lecture, scriptum (Moodle), selected articles in scientific journals.

Reading List:
Scriptum.
Taiz, L. and Zeiger, E. 2006: Plant Physiology.
Wien, H.C. 1997: The Physiology of Vegetable Crops.
Actual articles from scientific journals will be provided.

Responsible for Module:
Sieberer, Tobias; Dr. nat. techn.

Courses (Type of course, Weekly hours per semester), Instructor:
Crop Physiology: Growth and Development of Plants (Vorlesung, 4 SWS)
Sieberer T [L], Bienert G, Sieberer T
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1672: Crop Quality: Basics of Quality Control and Assurance | Crop Quality: Basics of Quality Control and Assurance

Version of module description: Gültig ab summerterm 2021

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

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

Description of Examination Method:
Aufgrund des Pandemiegeschehens hat der/die Studierende auch die Möglichkeit, an einer mündlichen Fernprüfung (Zoom, 30 min.) teilzunehmen (Onlineprüfung: WZ1672o). Eine schriftliche Prüfung wird zeitgleich parallel in Präsenz angeboten (WZ1672).

Students demonstrate their ability to understand quality control and assurance by applying non-destructive methods and to evaluate quality affecting factors in respect to horticultural crops by answering comprehension questions and solving sample problems in a written examination (120 min). Furthermore, students will be tested for their ability to analyze the import of secondary metabolites to the aroma of vegetable crops. The use of learning aids during the examination is not allowed. The answers to the examination questions requires writing a self-formulated text.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge in plant production and biochemical composition of vegetable and fruit crops.

Content:
Definitions and regulations for food crop quality, including quality assurance systems nationally and internationally. Non-destructive methods for measuring quality characteristics. Secondary plant metabolism and quality characteristics of vegetables. Sampling methods and determinations for external quality (color, texture, firmness, etc.) and internal quality (secondary metabolites, aroma compounds, carbohydrates, organic acids). Endogenous and exogenous factors on quality parameters of horticultural crops.

Intended Learning Outcomes:
Upon successful completion of this module, students are able:
- to understand quality control and maintenance measures and technologies;
- to apply non-destructive methods for testing quality characteristics of horticultural products;
- to apply the quality assurance systems for vegetables and fruits;
- to analyze the contribution of secondary metabolites to the aroma of vegetable crops;
- to evaluate the impact of endogenous and exogenous factors on external and internal quality parameters of horticultural crops.

Teaching and Learning Methods:
The learning contents are presented as PowerPoint-supported lectures to impart the theoretical background in horticultural crop quality. In addition, class discussions of case studies from literature are used to intensify the knowledge in special topics.

Media:
Presentation slides, lecture, scriptum (Moodle), selected articles in scientific journals.

Reading List:
Scriptum, actual articles from scientific journals will be provided.

Responsible for Module:
Ruth Habegger (ruth.habegger@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

WZ1673: Crop Biotechnology | Crop Biotechnology

Version of module description: Gültig ab summerterm 2015

Module Level:	Language:	Duration:	Frequency:
Master	English	one semester	winter semester
Credits:*	**Total Hours:**	**Self-study Hours:**	**Contact Hours:**
6	180	132	48

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

Description of Examination Method:
In a written exam (60 min) the students document a sound knowledge of the methods of genetics, molecular biology and biotechnology that are applied in plant sciences today. They demonstrate insight in technologies, aims and applications thereof. In addition, students are required to write a protocol about the practical course part which details the methods used and results obtained, and discusses the outcome. The over-all grade is calculate from the grade on the written exame and the grade obtained for the protocol (in equal weight).

Repeat Examination:

(Recommended) Prerequisites:
Basics in Genetics, Genomics, Plant development; Biochemistry and/or Botany

Content:
This course is conceived to give students an introduction into plant molecular biology and plant biotechnology and is composed of a lecture part (2 SWS) and a practical part (2 SWS). It provides a background in plant genetics and plant molecular biology, introduces principles of tissue culture and other technologies essential to generate transgenic plants and teaches methods required for research in plant molecular biology and plant biochemistry. Moreover, an overview of horticultural biotech crops on the market is given.
In addition to the lectures students get hands-on experience in using some of the methods presented. In a case study transgenic crop material is screened for in samples collected in Germany by using methods such as DNA extractions, restriction digests, PCRs, gel electrophoresis and sequencing.

Intended Learning Outcomes:
Upon completion of this module students are able to understand and assess methods and aims of Plant Biotechnology. They are capable of carrying our first lab-based experiments with methods of molecular biology and can interpret the results.

Teaching and Learning Methods:
Lecture: presentation of the lecture contends on slides using PowerPoint. Practical Part: teaching of research techniques with relevance for plant moleular biology and plant biotechnology using a case study

Media:
Slides of the lecture are available online

Reading List:
Biochemistry and Molecular Biology of Plants. Buchanan, Gruissem and Jones, John Wiley & Sons, 2002; The Condensed Protocols: From Molecular Cloning: A Laboratory Manual. Cold Spring Harbor Laboratory Press, 2006; Plant Biotechnology: The Genetic Manipulation of Plants. Adrian Slater, Nigel W. Scott und Mark R. Fowler, Oxford University Press, 2008.

Responsible for Module:
Brigitte Poppenberger (brigitte.poppenberger@wzw.tum.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Crop biotechnology (Vorlesung, 4 SWS)
Poppenberger-Sieberer B
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1674: Research Methods and Economic Research Project | Research Methods and Economic Research Project

Version of module description: Gültig ab summerterm 2015

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/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:
Examination Duration (in min.): 30.
The course grade consists of two parts: 50% project report and 50% in-class grade. The in-class grade consists of equal parts each, proposal presentation, project results presentation, peer review of another student's proposal, peer review of another student's project results, and discussion of applications of economic concepts.
Justification: Students demonstrate their ability to apply economic concepts through class discussions and development of project ideas.
Students demonstrate their ability to develop an economics research projects through the stages of proposal presentation, result presentation, and project report.
Students demonstrate their ability to evaluate other researchers' proposals and results in a constructive manner through presentations of reviews.
Students demonstrate their ability to manage resources, and deadlines through timely submission of the enumerated tasks in stages throughout their research projects.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
BSc. Degree. Prior knowledge of basic ideas of economics and management recommended.

Content:
The module provides master level students with an advanced understanding of the research process, its quality criteria, and the application of economic concepts to questions of food and agriculture. Key economic ideas are applied to everyday questions in class discussions based on economic texts, podcasts, and others. The development, execution, publication, and review of

disciplinary and interdisciplinary research is explained in lectures and carried out by each student from beginning to end.
Steps include developing project ideas and research questions; using peer-reviewed literature to frame a student project; designing research plans with the appropriate methods and suitable techniques of data collection; structuring, preparing, presenting, and critically reviewing research proposals; data collection, data analysis, and data presentation; discussion and conclusions based on reflecting own empirical research in the light of the literature; disciplinary, professional, and ethical quality criteria of research in economics and management

Intended Learning Outcomes:
Students are able to apply economic ideas to questions related to food and agriculture in everyday life.
Students are able to develop and execute an economic research project in the field of agriculture, horticulture, and food.
Specifically, students are able to develop a project idea, develop a research question and objectives based on the project idea and the related scientific literature, and create a research plan, including the suitable combination of research methods and techniques; defend a research proposal based on the research plan.
Students are able to evaluate other (student) researchers' proposals and present such evaluations in a suitable form, orally.
Furthermore, students are able to apply their research plan through data collection, data analysis, and presentation of research results, in oral and written form; and are able to evaluate other (student) researchers' research process, results, and conclusions.
Students are able to manage resources and deadlines.

Teaching and Learning Methods:
Lectures, class discussions, and guided student project development and project evaluation (project proposal, proposal review, project results, results review, and research report).

Media:
Presentation slides, websites, articles and short texts, multi-media (podcasts, video clips), student presentations, and reviews.

Reading List:
Hartford, Tim (latest edition). The Undercover Economist. Random House: New York.
O'Leary, Zina (latest edition). The Essential Guide to Doing Your Research Project. Sage: Los Angeles.
Committee on Science, Engineering, and Public Policy,
National Academy of Sciences, National Academy of
Engineering, and Institute of Medicine (latest edition). On Being a Scientist: A Guide to Responsible Conduct in Research.

Responsible for Module:
Vera Bitsch bitsch@tum.de

Courses (Type of course, Weekly hours per semester), Instructor:
Research Methods and Economic Research Project (WZ1559, WZ1674) (Seminar, 4 SWS)
Bitsch V [L], Bitsch V, Carlson L, Wagner C
For further information in this module, please click campus.tum.de or here.

Elective Courses | Elective Courses

Technical University of Munich | Technische Universität München

Module Description

WZ0630: Analysis of Epigenomic Data | Analysis of Epigenomic Data

Version of module description: Gültig ab winterterm 2019/20

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 10	**Total Hours:** 300	**Self-study Hours:** 150	**Contact Hours:** 150

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

Description of Examination Method:
Students will be evaluated by a report which is supplemented by a short presentation:
1. Written summary report (students will prepare a 10 page, double-spaced) summary report. The report will test their ability to summarize the datasets, analysis steps, and discuss the results of the analysis in the context of a specific biological hypothesis.
2. Presentation students will prepare a 15 min. presentation based on their written report. The presentation displays their ability to present their findings in a concise way to a peer group. They discuss their approach and results in the context of the research field and defend their work in a scientific debate.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Basic knowledge of computer systems and epigenetics.

Content:
Epigenetic modifications, such as DNA methylation or histone modifications, have a central role in the regulation of gene expression, particular in response to environmental and developmental cues. Next Generation Sequencing (NGS) technologies now allow us to measure the genome-wide patterns of various epigenetic modifications at unprecedented resolution. These technologies have opened up novel research avenues in basic and applied plant biology, including studies of development, stress response and natural variation. In this module students will be familiarized with the following NGS analysis steps:

- Introduction to Linux and R.
- Downloading NGS datasets from GEO public repository.
- Importing and manipulating NGS datasets.
- Alignment, trimming and quality filtering of ChIP-seq and WGBS sequencing reads.
- WGBS: Methylation state calling and detection of differentially methylated regions (DMRs).
- ChIP-seq: peak calling and differential enrichment analysis.
- Integration of WGBS and ChIP-seq with gene expression data.

Intended Learning Outcomes:
Upon successful completion of this module students are able to:
- Use Linux and the R computing environment.
- Distinguish epigenomic sequencing technologies such as chromatin immunoprecipitation followed by sequencing (ChIP-seq) and whole genome bisulphite sequencing (WGBS).
- Understand the structure of sequencing files.
- Manipulate and preprocess sequencing files.
- Apply software tools for analyzing ChIP-seq and WGBS data.
- Interpret the output from the data analysis.
- Query the results to answer specific biological questions.

Teaching and Learning Methods:
In the framework of this practical course students will work under close supervision on current research topics in plant epigenetics and epigenomics.

Teaching techniques:
- Computer practical.
- Individualized instructions.
- Critical discussion of analysis results with experienced supervisors and members of the research group.

Learning tasks:
- Literature studies.
- Hands-on computer-oriented tasks
- Preparation of research summaries in the form of a presentations and a written report.

Media:
Tutorials

Reading List:
Tutorials

Responsible for Module:
Frank Johannes f.johannes@tum.de

Courses (Type of course, Weekly hours per semester), Instructor:
Analysis of Epigenomic Data (Forschungspraktikum, 10 SWS)
Johannes F [L], Johannes F
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1596: Analysis of Bioactive Compounds in Fruits and Vegetables | Analysis of Bioactive Compounds in Fruits and Vegetables

Version of module description: Gültig ab summerterm 2015

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/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:
Regular participation in the laboratory training is expected. Each participant will give a presentation (15 min) about a practical experiment followed by a colloquium (15 min). These will show the competence regarding the theoretical aspects of plant analysis. In both the colloquium and the presentation (equal value), the students will show being able to sort and to demonstrate the steps of different analytical methods. A protocol about a laboratory experiment has to be prepared by each participant. This serves as a control tool for testing theoretical knowledge as well as the ability of the students to describe experimental results including their evaluation and interpretation. This written protocol is a subject of the colloquium.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
basic chemistry and biochemistry; recommended is participation of one of the following lectures: "Control and oprimization of secondray plant metabolites" or "Secondary plant metabolites and human health"

Content:
The course introduces into analysis and bioactivity of secondary plant metabolites. Different classes of bioactive substances will be covered, e.g. phenylpropanoids, flavonoids, carotenoids or terpenoids. A practical part deals with the isolation, identification and quantification of natural components and testing the bioactive (mainly antioxidative) capacity of the isolated substances

Intended Learning Outcomes:
The participants will have profound competence in analytics of secondary metabolites from plants including extraction, identification of structures, quantification. They will be able choose the

appropriate methods fo the respective analyses and will be able to adapt them to new demands. Finally, they are able to evaluate the experimental results.

Teaching and Learning Methods:
lecture, laboratory training, demonstration of experiments, personal advice, discussion of results with the supervisor and within the students teams, preparation of the experiments by reading the scriptum and literature in advance, carrying out a practicl project in a team and preparing a protocoll

Media:
lecture with powerpoint presentation, scriptum, practical laboratory training

Reading List:
C. Santos-Buelga, G. Williamson (Eds.), Methods in Polyphenol Analysis. The Royal Society of Chemistry, Athenaeum Press, 2003;
W. Feucht, D. Treutter: Phenolische Naturstoffe. Obst- u-. Gartenbauverlag München, 1989;
Goldberg, G. (ed.): Plants: Diet and Health; Blackwell Publishing, 2003

Responsible for Module:
Dieter Treutter (dieter.treutter@mytum.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung, Übung, Analysis of bioactive compounds in fruits and vegetables, 4SWS
Dieter Treutter (dieter.treutter@mytum.de) Susanne Rühmann (susanne.ruehmann@tum.de)
Ionela Regos (regos@wzw.tum.de)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1582: Applications of Evolutionary Theory in Agriculture | Applications of Evolutionary Theory in Agriculture

Version of module description: Gültig ab summerterm 2013

Module Level: Master	Language: English	Duration: one semester	Frequency: summer semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 120	**Contact Hours:** 30

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

Description of Examination Method:
Prüfungsdauer (in min.): 30.
There will be an oral exam consisting with questions (30 min.). No help is allowed. The students will need to show an understanding of the concepts of Evolutionary genetics. Short calculations are possible. This exam = 2/3 of the final mark. A 20min presentation of research papers on one of the four topics will be avaluated during the seminar part of the course. This presentation counts for 1/3 of the final mark.

Repeat Examination:

(Recommended) Prerequisites:
Basic knowledge in statistics and genetics, additional basic knowledge of phytopathology

Content:
1) Plant pathology and epidemiology: plant disease epidemiology principles, models of disease spread, consequence for agriculture, disease management and plant breeding.
2) Host-parasite coevolution: application of population genetics to plant-pathogen interactions, and animal-parasite coevolution, importance of gene-for-gene interactions, genomic studies of coevolution in cultivated species.
3) Evolution of pesticide/fungicide resistance: adaptive fitness landscapes, Fishers geometric model, consequences for fungicide use in the field.
4) Evolution of aggressiveness of pathogens in the field: theory of aggressiveness evolution, consequence for pathogen evolution and crop yield, Muller's Ratchet

Intended Learning Outcomes:
A profound understanding of the evolutionary mechanisms acting in agriculture based on the underlying theory, basic understanding of theory for disease management and epidemiology

Teaching and Learning Methods:
interactive lecture

Media:
Powerpoint presentations, software training, lecture, exercises, literature study, mutual questions and answers

Reading List:
Madden, Hughes, and van den Bosch 2007: The Study of Plant Disease Epidemics; Hartl and Clark 2007: Principles of Population Genetics 4th Edition; Hedrick 2009: Genetics Of Populations 4th Edition; Otto and Day 2007: A Biologist's Guide to Mathematical Modeling in Ecology and Evolution

Responsible for Module:
Aurélien Tellier (aurelien.tellier@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

WZ3098: Basics of Metabolomics | Basics of Metabolomics

Version of module description: Gültig ab winterterm 2018/19

Module Level: Master	**Language:** English	**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:
The examination consists of an oral presentation of 3-5 minutes (elevator pitch) (60% of final mark) and submission
of an maximum 6 page long abstract (40% of final mark) on the group work focusing on a specific problem.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
- basic knowledge of biochemistry
- basic statistical knowledge, e.g. t-test, etc.
- basic laboratory skills

Content:
Biochemical, analytical and data analytical basics of metabolomics are illustrated using relevant examples.
The following individual topics are covered:

biochemical basics
- Definition of systems biology and its disciplines (omics)
- Definition and aims of metabolomics and its role in systems biology
- relation of metabolomics to other omics-technologies

analytical basics
- basics of mass spectrometry (MS) and coupling of chromatographic methods
- application of MS in metabolomics
- basics of nuclear magnetic resonance (NMR) and its application in metabolomics

Metabolomics experiments
- experimental design
- sample preparation
- implementation of measurements
- quality control
- metabolite identification

data analytical basics
- basic statistical evaluation, e.g. HCA, PCA, PLS
- bioinformatic approaches

relevant applications
- in medicine, nutrition, food chemistry
- to model organisms
- in plant research and biotechnology

Intended Learning Outcomes:
The students are able to define the term of systems biology and to state its different disciplines.
Furthermore, they know different omics technologies and can separate them from each other.
The students are able to compare analytical methods used in metabolomics based on their advantages and
disadvantages and select a fitting method to solve a specific question. Moreover, they are able to apply basic
statistical data analysis methods on a given dataset and interpret the results in biochemical context. Additionally,
students are competent to perform problem-based literature research in relevant media.
On the basis of selected problems, students are able to question the current status of metabolomic research and
state possibilities for improvement.
They can draft plans and execution of metabolomics experiments and are able to comment on them.

Teaching and Learning Methods:
The module consists of a lecture, including expert input, single- and group work, case studies and student
presentations.

Media:
Script; slides

Reading List:
Metabolomics in Practice - Successful Strategies to Generate and Analyze Metabolic Data, 2013, 1. Auflage,

Wiley-VCH, ISBN: 9783527330898
- The Handbook of Metabonomics and Metabolomics, 2007, 1. Auflage, Elsevier, ISBN: 978-0-444-52841-4
- verschieden Original- und Übersichtsarbeiten

Responsible for Module:
Witting, Michael; Dr. Dr. rer. nat.

Courses (Type of course, Weekly hours per semester), Instructor:
Basics of Metabolomics (Vorlesung, 3 SWS)
Witting M
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1583: Biology and Physiology of Plant Stress | Biology and Physiology of Plant Stress

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 80	**Contact Hours:** 70

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

Description of Examination Method:
Exam [written 90 min. (3/6)] + presentation [oral 30 min. (2/6)] + laboratory [oral (1/6)]

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basics of Plant Physiology

Content:
Lecture / Seminar: definition, symptomology and physiology of stress in cultivated and model plants. Effects of various biotic and abiotic impacts on development, hormone metabolism, physiology and harvest of cultivated plants. Solutions for resistance / tolerance towards stress. Practical: symptomology of biotic and abiotic stress in higher plants. Measuring and modifying physiological stress parameters in exposed plants with different resistance properties. Requirements for selection of resistant genotypes physiological. Understanding and applying stress physiological variables. Methods: chlorophyll fluorescence, gas chromatography, enzymology

Intended Learning Outcomes:
Education to a stress physiologist, who is able to measure and comrehend patterns of stress for evaluation of performance and efficiency of plants exposed to different environmental conditions.

Teaching and Learning Methods:
Lecture, practices, seminar, laboratory

Media:
Powerpoint

Reading List:
Buchanan 2000: Biochemistry and Molecular Biology of Plants

Responsible for Module:
Ralph Hückelhoven hueckelhoven@wzw.tum.de

Courses (Type of course, Weekly hours per semester), Instructor:
Stressbiologie und -physiologie der Pflanzen (Seminar, 1 SWS)
Hückelhoven R [L], Hückelhoven R, Schempp H, Engelhardt S, Vlot-Schuster A, Durner J, Lindermayr C, Rosenkranz M, Stegmann M

Stressbiologie und -physiologie der Pflanzen (Vorlesung, 2 SWS)
Schempp H [L], Hückelhoven R, Vlot-Schuster A, Schempp H, Engelhardt S, Lindermayr C, Durner J, Rosenkranz M, Stegmann M
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1572: Biotechnology in Horticulture 1 | Biotechnology in Horticulture 1

Version of module description: Gültig ab summerterm 2015

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 6	**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 have to hand in short reports for each experiment. The student will get points for the accuracy of the results and for the quality of the report. The students demonstrate with the report that they are able to analyse and interpret data and present them in a scientific way. The main focus will be on the quality of the experimental work and thus, depending on the experiment, 70-80% of the points will be given for the result and 20-30% for the report. In addition, there will be three short individual interviews where the students demonstrate that they are familiar with the theoretical background and the protocols. For these interviews the students will also get points. The final mark will be given according to the total number of points the students received in the course. Typically, the experimental work, repots and interviews will account for approximately 70%, 20% and 10% of the total points, respectively.

Repeat Examination:

(Recommended) Prerequisites:
There are no requirements for attending this course

Content:
The students will learn basic techniques in plant biotechnology and plant molecular biology in theory and practice. In lectures the principles and theoretical background of the methods will be presented. Subsequently, the students have the opportunity to apply these methods practically and to discuss questions arising during experimental work with their supervisors.
There are several compulsory experiments which all students have to perform. In addition, the students can select from a number of additional experiments according to their interest and knowledge. Thus, this course is particularly suitable for students with no or little experience in

molecular plant biotechnology but also offers more experienced students an opportunity to improve their skills.

Intended Learning Outcomes:
After successful complletion of the module the students possess knowledge in the application of basic techniques in plant biotechnology and molecular biotechnology and the relevant theoretical background. They are able to use protocols, plan experimental work and perform basic experiments independently. In addition, they are able to analyse data by basic statistical methods, interpret the results of experiments and present them in a scientific way.

Teaching and Learning Methods:
Teaching method: presentation, experiments, individual laboratory work. Learning activities: practice laboratory skills, statistical evaluation of results, preparation of reports

Media:
Presentation, script, experimental laboratory work

Reading List:
The script for the course summarises the required theoretical background

Responsible for Module:
Wilfried Rozhon wilfried.rozhon@wzw.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

WZ1593: Biotechnology in Horticulture 2 | Biotechnology in Horticulture 2

Version of module description: Gültig ab summerterm 2015

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

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

Description of Examination Method:
The students prove in a written exam that they understand the theoretical background of basic methods and techniques in molecular biology, biotechnology, analytical chemistry, plant transformation and data evaluation. By preparing a written report the students demonstrate the ability to summarise and interpret data and to discuss them critically in the context of the literature. In addition, also the accuracy of the results and the experimental skills during the practical course will be graded.
The course grade consists of the written exam (20%), the report (40%) and the accuracy of the results and experimental skills (40%).

Repeat Examination:

(Recommended) Prerequisites:
Ideally, the students should have some experience in laboratory work. Theoretical knowledge in plant physiology, molecular biology and biotechnology is highly recommended.

Content:
This course focuses on plant biotechnology and molecular biology. The background of the experiments is presented in theoretical lectures ahead of the practical part. Subsequently, the students have the opportunity to apply plant biotechnological methods including:
*) DNA isolation, restriction analysis and PCR
*) Transformation of plants using Agrobacterium tumefaciens (transient and stable transformation)
*) Selection of transformants
*) Segregation analysis
*) Analysis of gene expression using reporter gens
*) Modification of compounds by biotechnological approaches

*) Purification and analysis of the obtained products using chromatographic methods

Intended Learning Outcomes:
After successful participation of the practical course the students are able to apply modern tools of molecular biology for analysis and manipulation of plants. Particularly, they know how to generate and select transgenic plants and analyse them by PCR-based genotyping. They will be able to use marker genes for expression analysis and to prepare, isolate and analyse plant metabolites by biotechnological methods. In addition, the students will be able to analyse data by basic statistical methods, interpret the results of experiments and present them in a scientific way.

Teaching and Learning Methods:
Teaching method: presentation, experiments, individual laboratory work. Learning activities: practice laboratory skills, statistical evaluation of results, preparation of reports

Media:
Presentation, script, experimental laboratory work

Reading List:
The script for the course provides detailed protocols for the experiments. For the theoretical background the following books are recommended:
Slater, Scott & Fowler: Plant Biotechnology 2nd edition (2008) Oxford University Press.
Griffiths, Wessler, Carroll and Doebley: Introduction to genetic analysis 10th edition (2011) W.H. Freeman.

Responsible for Module:
Brigitte Poppenberger (brigitte.poppenberger@wzw.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

WZ6309: Systematics of Spermatophytes | Botanik - Systematik der Samenpflanzen

Version of module description: Gültig ab winterterm 2020/21

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:
Die Prüfungsleistung dieses Moduls besteht aus einem Prüfungsparcours mit einer Klausur (60 min) und einer praktischen Prüfung (60 min).
Anhand der Klausur zeigen die Studierenden, dass sie sowohl die Diversität der Samenpflanzen mit ihren verschiedenen Anpassungen kennen, Bestäubungssyndrome verstanden haben, Beispiele für verschiedene Ausbreitungs- und Bestäubungsstrategien nennen und erklären können als auch die ca. 20 wichtigsten einheimischen Pflanzenfamilien erkennen und charakterisieren können.
In der praktischen Prüfung (60 min.) zur Artenkenntnis zeigen die Studierenden, dass sie eine Auswahl von Pflanzen direkt erkennen und weitere Pflanzen mithilfe eines Bestimmungsschlüssels identifizieren können.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:

Content:
Inhalt dieses Moduls sind:
- die Merkmale der ca. 20 wichtigsten Pflanzenfamilien der einheimischen Flora
- Bestimmung von Pflanzen dieser und weiterer Familien
- verschiedene Standorte mit den dort typischerweise vorkommenden Pflanzen
- weiterreichender Überblick über die Samenpflanzen mit Schwerpunkt bei der einheimischen Flora und Beispielen zur Nutzung und Ökologie.

Intended Learning Outcomes:
Nach der Teilnahme an der Modulveranstaltung können die Studierenden die wichtigen einheimischen Pflanzenfamilien (ca. 20) an ihren Merkmalen erkennen, benennen und charakterisieren. Sie kennen die Diversität der Samenpflanzen mit Beispielen zur Nutzung und zur Ökologie. Sie verstehen verschiedene Bestäubungs- und Ausbreitungsformen. Außerdem haben sie eine grundlegende Artenkenntnis in der einheimischen Flora gewonnen und die Fähigkeit erworben, Pflanzen mit entsprechender Literatur zu bestimmen und ein fachlich angemessenes Herbar anzulegen. Eine Auswahl von 100 Arten der heimischen Flora können sie ohne Bestimmungshilfe direkt identifizieren.

Teaching and Learning Methods:
Das Modul besteht aus einer Vorlesung und einer Übung. Ein Teil der Übungen findet im Gelände statt. In der Vorlesung wird den Studierenden ein weiterreichender Überblick über die Systematik der Samenpflanzen mit Schwerpunkt bei der einheimischen Flora gegeben. Ferner werden den Studierenden die Merkmale der ca. 20 wichtigsten Pflanzenfamilien der einheimischen Flora und verschiedene Standorte mit den dort typischerweise vorkommenden Pflanzen präsentiert.
In der Übung sollen die Studierenden Pflanzen mit entsprechender wissenschaftlicher Bestimmungsliteratur unter Anleitungsgesprächen und mit Ergebnisbesprechungen selbstständig in Partnerarbeit bestimmen. Dabei sollen die gängigen botanischen Bestimmungstechniken geübt werden.
Während der Freilandübungen lernen die Studierenden verschiedene Standorte mit den dort typischerweise vorkommenden Pflanzen kennen.
Zudem erstellen die Studierenden ein Herbar mit 20 wildwachsenden Pflanzen. Auf moodle wird den Studierenden Lernmaterial zur Vor- und Nachbereitung und Selbstlernkontrolle zur Verfügung gestellt.

Media:
Powerpoint-Folien, onlineted, Lernmaterialien zur Nachbereitung, Frageforum (Moodle), zusätzliche Übungsangebote (Pflanzen), Vortrag

Reading List:
Rothmaler - Exkursionsflora von Deutschland (oder andere Auflagen des Grundbandes);
Stützel, T.: Botanische Bestimmungsübungen
Bresinsky et al. (2014): Straßburger - Lehrbuch der Botanik

Responsible for Module:
Dawo, Ursula; Dr. agr.

Courses (Type of course, Weekly hours per semester), Instructor:
Botanische Übungen im Gelände (zu den Bestimmungsübungen für Lehramt, LARCH/LALP, UPIÖ) (Übung, 1 SWS)
Dawo U [L], Dawo U

Systematik der Samenpflanzen (für LARCH/LALP) (Vorlesung, 2 SWS)

Dawo U [L], Dawo U

Botanische Bestimmungsübungen (Übung, 3 SWS)
Dawo U [L], Dawo U
For further information in this module, please click campus.tum.de or here.

Module Description

WZ6430: Genetic and Environmental Control of Vegetal Plants | Genetic and Environmental Control of Vegetal Plants

Version of module description: Gültig ab summerterm 2021

Module Level: Master	**Language:** 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:
Aufgrund des Pandemiegeschehens hat der/die Studierende auch die Möglichkeit, an einer mündlichen Fernprüfung (30 min.) teilzunehmen (Onlineprüfung: WZ6430o). Diese mündliche Prüfung wird zeitgleich in Präsenz angeboten (WZ6430).

In the oral examination (30 min.) students demonstrate their ability to analyze the biochemical processes of primary and secondary plant metabolites and to analyze genetic potential, environmental and plant production factors and the role of mineral nutrition on the quality of vegetal plants. The students need to answer comprehension questions and solve sample problems. Furthermore, the ability is tested to conduct the Human Sensory evaluation on the analysis of aroma compounds of crops. Use of learning aids during the examination is not allowed.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Basic knowledge in plant production and crop quality.

Content:
Dependence of aroma compounds in vegetal crops on genetic potential and environmental conditions during cultivation of plants. Knowledge of special extraction and analysis methods for aroma compounds. Basics of Human Sensory analysis and application for vegetal crops. Correlation between analytical and sensory methods. The functions of mineral nutrients (N, K, P, S, Ca, Mg, trace elements) in plant metabolism and their impact on plant composition with respect to internal nutritional and processing properties. Effect of the supply of mineral nutrients on external

and internal parameters of plant quality; the influence of the physiological function of nutrients on quality defining products of primary and secondary plant metabolism.

Intended Learning Outcomes:
Upon successful completion of this module, students are able:
- to apply Human Sensory evaluation on the analysis of aroma compounds of vegetal crops;
- to analyze the effects of genetic potential and environmental and plant production factors on aroma relevant plant compounds;
- to analyze how physiological functions of nutrients can affect quality defining products of primary and secondary plant metabolism;
- to evaluate the role of the supply of mineral nutrients (fertilization) on external and internal quality parameters in relation to other exogenous factors;
- to chose appropriate instruments, measuring methods and analytical tools;
- to evaluate the differences of methods for analyzing internal quality parameters by using analytical tools and instruments and interpreting measured data.

Teaching and Learning Methods:
The knowledge will be imparted by PowerPoint-supported lectures to transfer the specialized knowledge about effect of genetic potential and environmental conditions on plant metabolites and the functions of mineral nutrients in plant metabolism. In addition, class discussion of case studies from literature are conducted to intensify the knowledge in relevant topics. In the lab exercise course students will define and solve problems in the chemical analysis of internal quality parameters. They will get practice in laboratory skills by performing experiments.

Media:
Presentation; lecture, scriptum (Moodle), demonstration and lab practical in labs.

Reading List:
Taiz, L. and Zeiger, E. 2006: Plant Physiology.
Belitz, H.D.; Grosch, W.; Schieberle, P. 2009: Food Chemistry.
Stone, H. and Sidel, J.L. 1993: Sensory Evaluation Practices.
Marschner, H. 1995: Mineral Nutrition of Higher Plants. 2nd edition.
Marschner, P. (ed.) 2012: Marschner's Mineral Nutrition of Higher Plants. 3rd edition.

Responsible for Module:
Habegger, Ruth; Dr. rer. hort.

Courses (Type of course, Weekly hours per semester), Instructor:
Aroma compounds of vegetal plants (Vorlesung, 1,5 SWS)
Habegger R [L], Habegger R

Analysis of quality parameters (Übung, 1 SWS)
Habegger R [L], Habegger R, von Tucher S

Plant mineral nutrition and crop quality (Vorlesung, 1,5 SWS)
Habegger R, von Tucher S
For further information in this module, please click campus.tum.de or here.

Module Description

WI001205: People in Organizations: Managing Change and Sustainability in Agribusiness and the Food Industry | People in Organizations: Managing Change and Sustainability in Agribusiness and the Food Industry

Version of module description: Gültig ab winterterm 2018/19

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

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

Description of Examination Method:
The assessment type for the module is a graded report (100%). The report includes memorandums addressing 9-10 of the case studies discussed in class; and a concept paper addressing an organizational concept. The concept paper is also presented by each student. Through the case memorandums, the students demonstrate the ability to discuss the assigned case questions by selecting and applying suitable theoretical concepts to agribusiness and the food industry. Building on the reflection process for each individual memorandum and the cases, which build on each other, deep-level contextual learning is achieved. In the concept paper, students demonstrate their ability to research and critically evaluate a current organizational concept. Through the presentation and discussion of the concept paper, students demonstrate their ability to communicate theoretical concepts and their application to agribusiness and the food industry.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
This is an advanced module. Prior knowledge of economic and management concepts is required. Successful completion of a management course on MSc. level is required, e.g., Human Resource Management in Agriculture and Related Industries or Agribusiness Management. Experience in desk research and scientific writing is required. Knowledge of basic concepts of human resource management and management skills is required.

Content:
The module builds on key concepts of economics and management, specifically human resource management, to provide master level students with knowledge in organizational behavior, theory, and development and build competencies in organizational analysis and change.
Topics covered include:
- metaphors of and perspectives on organizations, their strengths and limitations
- the role of the individual, the group, and the organization in a high performance environment
- organizational structures and the organization-environment fit
- corporate social responsibility, sustainability challenges, business ethics, and ethical conduct in bio-based industries
- adapting to current challenges and changes in the institutional environment of agriculture and the food industry
- understanding organizational change, facilitating change processes, and overcoming barriers in the context of agribusiness and the food industry.

Intended Learning Outcomes:
After successfully completing the module students are able to analyze, evaluate, and change organizational management and development practices in the agribusiness and food industry context. Specifically, students are able to
˜ select and apply suitable theoretical concepts or models of organizational behavior, theory, and development to meet organizational challenges in agribusiness and the food industry
- contrast the strengths and limitations of different perspectives on organizations
- evaluate the potential impacts of various organizational management options on the individual, group, and organizational levels
- identify ethical challenges and options to organizations in agribusiness and the food industry
- adapt organizational practices and policies to sustainability measurement requirements and develop organizational sustainability or CSR (corporate social responsibility) policies
- structure organizational change processes, apply models of organizational change, and evaluate a model’s potential implications
- adapt organizational management and development practices to the specific context in agribusinsess and the food industry.

Teaching and Learning Methods:
The course People in Organizations: Managing Change and Sustainability in Agribusiness and the Food Industry has a seminar format based on the case study method. The seminar format is implemented based on case descriptions of problems, challenges, and innovations in agribusiness and food industry supply chains. Through individual document research and individually prepared class discussions and group work, students develop the ability to critically reflect on and apply concepts of organizational behavior, theory, and development in the context of agribusiness and the food industry. Through presentations and concept discussions, students develop in-depth knowledge of exemplary theoretical concepts. During class discussions and group presentations, students reflect on their experiences, prior knowledge, and assignments to develop their conceptual and evaluative skills and to adapt theoretical knowledge to practical challenges

Media:
Reading assignments; case descriptions; presentation software; discussion facilitation support media, such as flipcharts and discussion boards; video clips and podcasts.

Reading List:
Selected chapters from
Brown, Donald R. (latest edition). An Experiential Approach to Organization Development, Prentice Hall: Boston.
Daft, Richard L. (latest edition). Organizational Theory and Design. South-Western/Cengage Learning.
Kreitner, Robert and Kinicki, Angelo (latest edition). Organizational Behavior. McGraw-Hill Irwin.
Morgan, Gareth 2006. Images of Organization. Updated ed., Sage: Thousand Oaks/CA.

Responsible for Module:
Vera Bitsch bitsch@tum.de

Courses (Type of course, Weekly hours per semester), Instructor:
People in Organizations: Managing Change and Sustainability in Agribusiness and Food Industry (WZ1563, WI001205) (Seminar, 4 SWS)
Bitsch V [L], Bitsch V, Huhn C, Wagner C
For further information in this module, please click campus.tum.de or here.

Module Description

WZ0261: Simulation of Cropping Systems | Simulation of Cropping Systems

Simulation

Version of module description: Gültig ab summerterm 2022

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 82.5	**Contact Hours:** 67.5

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

Description of Examination Method:
The examination performance will be in the form of a project work presentation. The project report will describe a systems problem in cropping, its translation into a scientific question and the application of a crop model in R to answer this question. The project report will be about 12 pages and must be presented at the end of the semester in a final presentation. The report, presentation and discussion should show that participants have an ability to sufficiently understand the context of cropping systems, the interactions between different plant resources such as light and water and have developed a critical view of model abstraction versus real systems. They need to show an ability to understand the potential of models to gain new inside in to cropping systems as well as the limitations of crop models to simulate such system. The report and the presentation are the final type of assessment. By passing additional brief quizzes that are offered during the semester each students gets the chance to get an 0.3 grade bonus if the final assessment is passed and 75% of the quizzes are passed, too. A repetition of the midterm assessments is not possible. If a repetition exam is taken in the following semester and the grade bonus was achieved, it will be transferred.
The possibility of repetition of the exam is given at the end of the semester.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Basic knowledge in biology, crop physiology, physics, chemistry, hydrology, mathematics, statistics and programming language R, based on the bachelor's degree in Agricultural and Horticultural Sciences

Content:
The module includes aspects of the yield physiology of crops: C-balance (photosynthesis, respiration, C-allocation), water balance, light uptake, growth and development and model representations of these components in a cropping system with numerical solutions, crop models and coding in R.

The course will contain two components. First, students will be exposed to basic concepts of systems analysis, modeling and computer simulation of agricultural and biological systems. Emphasis will be placed on continuous simulation of dynamic models with examples that give students a broad exposure to dynamic simulation models. An overview of applications of models in agricultural and biological systems will be given. Basics of working with R and a simple crop model developed in R will be taught via e-learning tools and seminars during this first half of the semester.

The second part of the course will introduce students to a simple dynamic crop simulation model. They will apply their knowledge of R and the simple crop model in R, to modify the model and apply it for a class projects. Lectures will expose the students to various methods for working with dynamic models, including parameter estimation, model evaluation, and sensitivity analysis which they will apply in a project work. Students will also be exposed to uncertainties in models associated with uncertainties in model parameters, inputs, and structure.

Intended Learning Outcomes:
After successfully completing the module, students are able to:
- Understand general concepts of cropping systems and crop simulation models, including Systems Approach, Model development, Example models and Numerical Simulation,
- Create basic routines to simulate dynamic behavior using numerical solutions,
- Understand a simple crop simulation model in R, supplied from the literature, with the basic structures of a cropping system,
- Apply a simple crop model in R to a new problem using Parameter estimation, Model evaluation and Sensitivity analysis,
- Evaluate crop model performance in R with field experimental data,
- Understand the potential of models to gain new systems inside in cropping systems analysis,
- Understand the limitations of crop models to simulate a cropping system,
- Analyze model uncertainty.

Teaching and Learning Methods:
The basic modeling approaches of cropping systems processes are presented and supplemented in the lectures by example from different models and recent research. In the accompanying exercises, parallel to lecture material, student will individually read scientific literature and carry out exercises on methods of model development, parameterization, evaluation, sensitivity analysis and uncertainty analysis. In a seminar setting, the first part of the semester will be accompanied with e-learning developed for this module, they will learn the basics of R and how a simple model is applied in R (1SWS for first half of semester). Students will prepare homework exercises on model creation and discuss these and literature in class. The lectures will be accompanied with

regular brief quizzes to test their comprehension of new definitions and concepts. Students are encouraged to assist each other in homework (understanding reading material and in performing specific modeling tasks) and during discussion in class.

Media:
PowerPoint Presentations, leaflet of the lecture in pdf format, E-modules (brief videos), exercise portfolio and quizzes.

Reading List:
Handouts will include pages from:
Wallach, D., D. Makowski J. W. Jones and F. Brun. 2019. Working with Dynamic Crop Models. Methods, Tools and Examples for Agriculture and Environment. Third Edition. Academic Press, London.
Keen, R.E. and J.D. Spain. 1992. Computer simulation in Biology: A Basic Introduction. Wiley-Liss Inc. New York. (Selected Chapters - Book out of print.)
Jones, J.W. and Luyten, J.C. 1998. simulation of Biological Processes. In: Peart, R.M. and Curry, R.B. (eds). Agricultural Systems Modeling and Simulation. Marcel Dekker Inc. ISBN 0-827-0041-4.
Thornley, John H.M. and Ian R. Johnson.2000. Pland and Crop Modeling: A Mathematical Approach to Plant and Crop Physiology. Oxford University Press. New York. Blackburn Press (Second Printing.)

Additional Readings:
De Wit, C.T., 1992. Resource use efficiency in agriculture. Elsevier Applied Science, London.
Landau, S., Mitchell, R.A.C., Barnett, V., Colls, J.J., Craigon, J., Moore, K.L., Payne, R.W., 1998. Testing winter wheat simulation models' predictions against observed UK grain yields. Agricultural and Forest Meteorology 89, 85-99.
Lobell, D.B., Cassman, K.G., Field, C.B., 2009. Crop Yield Gaps: Their Importance, Magnitudes, and Causes. Annual Review of Environment and Resources 34, 179-204.
Lobell, D.B., Field, C.B., 2007. Global scale climate - crop yield relationships and the impacts of recent warming. Environmental Research Letters 2.
Sinclair, T.R., Muchow, R.C., 1999. Radiation use efficiency. Advances in Agronomy 65, 215-265.
Asseng S, et al. (2015) Rising temperatures reduce global wheat production. Nature Climate Change 5:143-147.
Asseng S, et al. (2013) Uncertainty in simulating wheat yields under climate change. Nature Climate Change 3:827-832.
Chenu K, Porter JR, Martre P, Basso B, Chapman SC, Ewert F, Bindi M, Asseng S (2017) Contribution of crop models to adaptation in wheat. Trends in Plant Science 22:472-490.
Lobell DB, Asseng S (2017) Comparing estimates of climate change impacts from process-based and statistical crop models. Environmental Research Letters 12.
Zhao C, Liu B, Xiao LJ, Hoogenboom G, Boote KJ, Kassie BT, Pavan W, Shelia V, Kim KS, Hernandez-Ochoa IM, Wallach D, Porter CH, Stockle CO, Zhu Y, Asseng S (2019) A SIMPLE crop model. European Journal of Agronomy 104:97-106.
Zotarelli et al. 2010 Step by Step Calculation of the Penman-Monteith Evapotranspiration (FAO-56 Method), IFAS Publication, University of Florida

Responsible for Module:
Asseng, Senthold; Prof. Prof. Dr. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Simulation Cropping Systems (Vorlesung mit integrierten Übungen, 4 SWS)
Asseng S [L], Asseng S, De Souza Noia Junior R

R for crop modelling (Übung, 2 SWS)
De Souza Noia Junior R [L], De Souza Noia Junior R
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1594: Biotechnology in Horticulture 3 | Biotechnology in Horticulture 3

Version of module description: Gültig ab summerterm 2015

Module Level: Master	Language: English	Duration: one semester	Frequency: summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 124	**Contact Hours:** 56

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

Description of Examination Method:
The course grade consists of three parts: written examination (20%), project report (40%) and in-class grade (40%). In the written examination the students prove by answering questions and perfoming examplary calculations that they made themselves acqainted with the theoretical background of generation and characterization of transgenic plants and biotransformation approaches. By preparing the written report the students demonstrate the ability to summarize the key aims of the performed experiments, to present the aquired results in a consice and coherent manner and to interpret and discuss the experimental data in the context of available literature. The in-class grade reflects the level of active involvement and experimental/ intellectual skills during the practical course.

Repeat Examination:

(Recommended) Prerequisites:
Theoretical knowledge in plant biology and biotechnology is recommended. Basic techniques of working in a molecular biology laboratory are an advantage.

Content:
This course is offered for students with interest in molecular plant biotechnology. The participants get acquainted with basic plant biotechnological methods including: Generation and analysis of transgenic plants:
*) Stable transformation by floral dip
*) Segregation analysis of transgenic plants
*) Genotyping (PCR)
*) Transient transformation by infiltration of leaves
*) Expression analysis (GUS staining)

Biotechnological preparation of chemicals:
*) Expression of a plant protein in bacteria
*) Glucosylation of compounds
*) Analysis of the obtained product

Intended Learning Outcomes:
After succesful participation of the practical course, students are able: 1) to generate transgenic plants (Arabidopsis and horticultural crops) in a stable and transient manner 2) to determine the presence of a transgene in plants by resistance marker selection and PCR genotyping 3) to analyse the level of transgene expression using the GUS reporter system 4) to produce and purify a plant metabolite in E.coli by heterologous expression of a plant enzyme. The students obtain a first impression of plant biotechnology approaches. They acquire theoretical and practical knowledge of how to address research questions in horticulture with modern tools of molecular biology.

Teaching and Learning Methods:
Introductory lectures to provide the theoretical background about the experimental appoaches. Supervised practical lab course with step by step instructions to perform described experiments. Joint analysis and interpretation of obtained results.

Media:
Presentation slides from the introductory lectures; Bench based scientific research is performed in groups of two persons. Students are provided with a work instruction booklet to carry out relevant experiments and are closely supervised during all steps of the course.

Reading List:
A work instruction booklet will be provided at the start of the practical course. Background literature: Slater, Scott & Fowler: Plant Biotechnology 2nd edition (2008) Oxford University Press; Griffiths, Wessler, Carroll and Doebley: Introduction to genetic analysis 10th edition (2011) W.H. Freeman.

Responsible for Module:
Tobias Sieberer (tobias.sieberer@tum.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Übung, Biotechnology in Horticulture 3, 4SWS
Tobias Sieberer (tobias.sieberer@tum.de)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1597: Control and Optimisation of Secondary Plant Metabolites | Control and Optimisation of Secondary Plant Metabolites

Version of module description: Gültig ab summerterm 2015

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

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

Description of Examination Method:
The oral exam is the platform where the students demonstrate their knowledge on the role of secondary plant metabolites in plant physiology and resistance. They show that they understand the methods how to manage secondary metabolism in crop plants and that they are able to critically reflect their applications.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Basics in plant biology, chemistry and biochemistry

Content:
The role of secondary compounds in plant physiology and resistance. Human health aspects. Influence of environment, agricultural practices, and post-harvest conditions on biosynthesis and content of bioactive compounds. Managing phenolic compounds in crop plants (breeding, production technology).

Intended Learning Outcomes:
The participants have knowledge on management of bioactive plant metabolites by cultivation technology and effect of environmental factors; they have knowledge on genetics, biosynthesis and structures of secondary plant metabolites; evaluation of possible functions in plants and they have basic knowledge on analytical methods for quantification, structural elucidation of secondary metabolites and on estimation of antioxidant capacity. They are able to evaluate methods for management the content of secondary metabolites in crop plants.

Teaching and Learning Methods:
An interactive lecture is the method of choice for offering the broad subject of the module and for discussing the interaction of the environment and the plant metabolism with the students. An interactive lecture includes the presentation of basics and its flexible adaptation according to the previous knowledge of the students by the lecturer. This offers the chance to guide the student to critically evaluate methods for management secondary plant metabolism.

Media:
Presentation, scriptum, laboratory training

Reading List:
E. Grotewold, The Science of Flavonoids. Springer, 2006
J. B. Harborne, Introduction to Ecological Biochemistry. Academic Press, 1993
E. Haslam, Practical Polyphenolics. Cambridge University Press, 1998
C. Santos-Buelga, G. Williamson (Eds.), Methods in Polyphenol Analysis. The Royal Society of Chemistry, Athenaeum Press, 2003
J.-J. Macheix, A. Fleuriet, C. Jay-Allemand, Les Composés Phénoliques des Vegetaux. Presses Polytechniques et Universitaires Romandes, 2005
W. Feucht, D. Treutter, Phenolische Naturstoffe, Ihre Bedeutung für Gartenbau, Land- und Forstwirtschaft, München, 1989

Responsible for Module:

Courses (Type of course, Weekly hours per semester), Instructor:
920534918 Control and optimization of secondary plant metabolites (4SWS VO, SS 2016/17) [GP]

Treutter D [L], Steger S, Stammler J
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1720: Crop Breeding | Crop Breeding

Version of module description: Gültig ab summerterm 2021

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

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

Description of Examination Method:
The final examination is a written test (120 min, Klausur) without additional material. Students demonstrate in the exam that they are capable to design field and laboratory experiments, to analyze different genetic parameters and to interpret the results. They can explain important quantitative genetic parameters and their relevance for selection and for the optimization of horticultural crop breeding programs. They can show how the phenotypic and molecular diversity of plant breeding populations and genetic resources is characterized. Students are able to explain the molecular tools for genomic and genetic analyses and to evaluate which methods are appropriate for specific scenarios. The grade of the exam will be the final grade of the module.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Successful Bachelor courses in biology, genetics, plant breeding, and applied statistics.

Content:
This module presents molecular tools for forward and reverse genetic analysis, such as linkage analysis, tilling, transposon tagging and gene editing. Different experimental designs and their underlying randomization will be shown. The module presents the theoretical concepts behind an analysis of variance of phenotypic and molecular data (ANOVA, AMOVA). Specific properties of breeding schemes of horticultural crops will be connected to their biological properties. The importance of native biodiversity for plant breeding will be discussed. Methods for valorization of plant genetic resources are presented.

Intended Learning Outcomes:
After successful completion of the module, students can design field and laboratory experiments relevant for crop breeding. They will be able to perform a profound statistical analysis on these experiments, interpret their results, understand the relevance of different variance component estimators for breeding and calculate derived genetic parameters such as trait heritability. They will become familiar with trait correlations and how these correlations can be relevant for selection. Students will be able to characterize and evaluate plant breeding populations and plant genetic resources with respect to their phenotypic and molecular diversity. They acquire an understanding of molecular tools employed in genomic and genetic analysis. Students will be able to integrate the different methods and tools they have learnt to design and optimize breeding programs of horticultural crops.

Teaching and Learning Methods:
The module consists of a lecture with PowerPoint presentations accompanied with practical demonstrations at the computer and in the lab. Students will perform a greenhouse experiment in which they will collect phenotypic data, connect it to molecular data and will perform analyses taught during the course. Students are encouraged to present literature studies.

Media:
PowerPoint presentations, panel work, exercises, presentation of current literature.

Reading List:
Rex Bernardo (2014): Essentials of Plant Breeding, Stemma Press, ISBN: 978-0-9720724-2-7
Michael Lynch and Bruce Walsh (1998): Genetics and Analysis of Quantitative Traits; Sinauer Verlag, ISBN 978-0878934812

Responsible for Module:
Schön, Chris-Carolin; Prof. Dr.sc.agr. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Crop Breeding (Vorlesung, 4 SWS)
Schön C, Avramova V, Eggels S, Lanzl T
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1588: Evolutionary Genetics of Plants and Microorganisms | Evolutionary Genetics of Plants and Microorganisms

Version of module description: Gültig ab winterterm 2019/20

Module Level: Master	**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:
The examination consists of an oral exam (30 min). The students are given a dataset to analyze for 30 mins of preparation time. The aim of this study is to demonstrate that the students can analyze and interpret genetic diversity data obtained as sequence of few genes or full genomes. The exam questions cover in particular the interpretation of the computed statistics. This includes, for example, analyzing published data using the program DnaSP (on their own computer provided or provided one), explaining the underlying principles of evolutionary genetics and population genetics, as well as the evaluation and interpretation of the results. The students should for example, explain how the effects of evolution influence sequence data polymorphism, and how the mathematical models of this course predict these outcomes

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Basic knowledge in genetics and statistics.

Content:
1) Molecular evolution: Hardy-Weinberg equilibrium, neutral … evolution, mutation-drift equilibrium, natural selection, models of speciation, molecular clock, sexual reproduction and recombination. …
2) Population genetics and their application in the genome analysis of plants and microorganisms: coalescence models, application of the coalescent in genome analysis for detection of selection, analysis of population structure, inference of past demographic history. …
3) Population genetics and plant breeding: history of plant breeding, examples of domestication processes, effects of domestication on the genome.

Intended Learning Outcomes:
At the end of the module the students can 1) apply general methods for acquiring published data from internet databases. They 2) can independently analyze DNA sequences with the software DnaSP. 3) The students understand the principles of evolutionary genetics and population genetics, for example the effects and change in frequencies of mutations in populations, the role of natural selection and link to phenotyping, and the role and importance of stochastic processes in evolution. They can analyze the effects of these mechanisms in genetic data, and independently apply such analyses on full genomes. 4) The students can apply, evaluate and critically discuss the basics of population genetics theory, especially for its application to plant breeding. In principle, the students can use this knowledge also in the field of animal breeding, evolutionary ecology or human evolution. They are able to critically analyze published results in these areas, possibly further develop novel data analyses using full genomes and apply the concepts and techniques to any species.

Teaching and Learning Methods:
Teaching method: The course includes 2 SWS lectures and 2 SWS exercises. The lectures provide the theoretical and mathematical background to the theory of evolution. During exercises, the software DnaSP is used for sequence data analysis. In the exercises, the students apply the classical statistics computed from population polymorphism and also discuss their interpretation in connection to the theory.
Learning Activity: Study of scientific articles on plant breeding or human evolution and critical analysis of the published results. The exercises develop the process of problem solving and finding interpretation of the data.

Media:
Presentations with PowerPoint, software used: DnaSP, R statistics and coalescent simulators.

Reading List:
Hartl and Clark, Principles of Population Genetics 4th Edition (2007);
Hedrick, Genetics Of Populations 4th Edition (2009); Wakeley, Coalescent Theory: An Introduction (2008)

Responsible for Module:
Tellier, Aurélien; 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

WZ2762: Research Project Molecular Genetics of Plant-Microbe Symbiosis 2 | Forschungspraktikum Molekulare Genetik der Pflanzen-Mikrobien Symbiose 2

Version of module description: Gültig ab winterterm 2017/18

Module Level: Master	**Language:** 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:
The students conduct an own small research project, which requires a minimum of 40h of laboratory and/or computer work per week. The work-schedule can be adjusted with the curriculum of the students. After the practical work, a report has to be prepared and handed in a few weeks after the laboratory work has been concluded. Furthermore, the students present their work in a 15-minute presentation in English in the frame of the lab progress report seminar. The evaluation of the research course will be based on an evaluation sheet containing several categories and designed to enhance the objectivity of the grading. For transparency, the sheet will be handed to the students prior to the start of the research course. 80% of the grade will be based on the quantity and quality of laboratory work and the quality of the report (writing and figures of publication quality). 20% of the grade will be based on the quality of the oral presentation.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Fundamental knowledge of molecular biology, genetics and/or plant biology is required. Students should have basic competences in molecular biology lab work such as accurate pipetting and correct preparation of solutions (including all necessary calculations of molarity etc). Proficiency in basic computer software such as Word, Excel and Power Point is a must. Basic knowledge in R, ImageJ and/or Illustrator is an advantage.

Content:
In the research course the students acquire competence and knowledge in one of the following subjects: a) Plant hormone signalling in plant symbiosis, b) transcriptional regulation of plant symbiosis, c) nutrient exchange in plant symbiosis.

Techniques and methods will depend on the individual project and may include: golden gate cloning, plant transformation, quantitative real time PCR, phenotypic analysis of roots and fungal structures by microscopy, fluorescence microscopy and analysis of subcellular compartments with fluorescent fusion proteins, handling of plants and arbuscular mycorrhiza fungi, hormone physiology, transactivation assays, protein expression and purification, protein-protein interaction techniques (yeast-2-hybrid, CoIP), genetic mapping or genotyping, data analysis using R, preparation of figures in publication quality.
Many of these techniques are transferable to other (non-plant) organisms.

Intended Learning Outcomes:
After a successful completion of the course the students have acquired competence in several laboratory techniques related to plant molecular biology and general molecular biology and genetics, writing of a laboratory book and efficient time management by running several experiments in parallel. They have learned how to design experiments with all necessary controls, how to interpret results and how to perform basic statistical data analysis using R. Furthermore, they have increased their competence in scientific writing and have learned how to display scientific data and microscopy images in publication quality.

Teaching and Learning Methods:
Combination of close practical and theoretical supervision and independent work. Reading and understanding of laboratory protocols, writing of laboratory book. Time management in the laboratory. Reading of original research articles.

Media:
The students will use lab protocols to learn and conduct experiments by themselves but under close supervision. Supervised and independent use of lab instruments and software such as DNA analysis software, ImageJ and/or Illustrator.

Reading List:
Original articles and reviews for preparation of the research course will be provided prior to the start of the research course. For prior information about the main research focus of the laboratory we recommend the review: Gutjahr and Parniske, 2013, Ann. Rev. Cell Dev. Biol., which can be downloaded using the following link:
http://www.annualreviews.org/doi/full/10.1146/annurev-cellbio-101512-122413

Responsible for Module:
Gutjahr, Caroline; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Research Project - Molecular genetics of plant-microbe symbiosis 2c (Forschungspraktikum, 10 SWS)
Gutjahr C

Research Project - Molecular genetics of plant-microbe symbiosis 2a (Forschungspraktikum, 10 SWS)
Gutjahr C [L], Torabi S

Research Project - Molecular genetics of plant-microbe symbiosis 2b (Forschungspraktikum, 10 SWS)
Gutjahr C, Torabi S
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1060: Precision Agriculture | Precision Agriculture

Version of module description: Gültig ab summerterm 2022

Module Level: Master	Language: 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 module uses a written exam (120 min) for assessment, which mainly based on the criteria below:
- demonstrated understanding of the basic concepts of precision agriculture, and the fundamentals of the key technologies;
- know how to assess the effects precision farming technologies from a systems perspective;
- ability to analyze and interpret the biological meanings of sensor data for decision making;
- ability to apply techniques to certain problems of crop management; and
- critical thinking skills, for instance, the ability of comparing and evaluating different sensing and modeling methods, and assessing the limitations of each method in solving certain problems;

Repeat Examination:
Next semester

(Recommended) Prerequisites:
- Basic knowledge of agricultural engineering
- Basic knowledge of plant and soil sciences

Content:
The module introduces the concept, principles of precision farming technologies, and their applications and economics. Main topics include:
1. concept and technological advances of precision agriculture;
2. key supporting technologies including remote sensing, geographic information system (GIS), global positions system (GPS), navigation, robotics, automation and communication technologies, sensors and sensor-carrying platforms, and variable rate technology (VRT);
3. soil spatial variability (e.g. nutrient, water) measurement and management;
4. crop spatial variability (e.g. health, stress) and site-specific crop management;

5. yield monitoring and grain quality analysis;
6. plant phenotyping technologies and applications;
7. big data analysis in precision agriculture and plant phenotyping;
8. environmental and ecological implications of precision agriculture;
9. economics and adoption of precision farming technologies; and
10. challenges and future directions of precision agriculture.

Intended Learning Outcomes:
Upon successful completion of this module, students will be able to,
- understand the concept, technologies and principles of precision agriculture;
- apply sensing and modeling methods to analyze soil and crop spatial variability;
- analyze the problems of crop growth and health using sensing and modeling methods;
- evaluate the robustness and transferability of sensing and modelling methods;
- develop critical thinking ability for applying precision agriculture technologies for decision making;
- create strategies based on multidisciplinary knowledge and techniques to solve practical problems in precision agriculture.

Teaching and Learning Methods:
- The module will be instructed through lectures, and lectures with integrated (computer) exercises in order to enable students master the theoretical basis and practical skills of precision agriculture.
- The lecture serves as a systematical introduction of the knowledge and theoretical basis of precision agriculture. Case studies are used to deepen the understanding of knowledge and stimulate interactions.
- The exercises teach the practical applications through field visits, independent measuring and interpreting soil and crop variability using various sensors and modeling methods. The exercises also include computer exercises of analyzing and interpreting results based on several pre-collected example datasets.
- Students apply the knowledge and practical methods for exercises, conduct exercises through team work and discuss the results with the instructor and classmates.

Media:
PowerPoint, Scripts, computer exercise portfolio, TUM-Moodle, Zoom

Reading List:
Shannon, D.K., D. E. Clay, and N. R. Kitchen. 2018. Precision Agriculture Basics. ASA, CSSA and SSSA, Madison, WI, USA.
Bechar, A., 2021. Innovation in Agricultural Robotics for Precision Agriculture: A Roadmap for Integrating Robots in Precision Agriculture, 1st ed, Progress in Precision Agriculture. Springer, Cham.

Responsible for Module:
Yu, Kang; Prof. Dr. rer. nat.

Courses (Type of course, Weekly hours per semester), Instructor:
Precision Agriculture (Vorlesung mit integrierten Übungen, 4 SWS)
Yu K, Oksanen T, Bernhardt H, Gandorfer M
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1595: Genetic and Environmental Control of Vegetal Plants | Genetic and Environmental Control of Vegetal Plants

Version of module description: Gültig ab summerterm 2018

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

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

Description of Examination Method:
In the oral examination (30 min.) students demonstrate their ability to analyze the biochemical processes of primary and secondary plant metabolites and to analyze genetic potential, environmental and plant production factors and the role of mineral nutrition on the quality of vegetal plants. The students need to answer comprehension questions and solve sample problems. Furthermore, the ability is tested to conduct the Human Sensory evaluation on the analysis of aroma compounds of crops. Use of learning aids during the examination is not allowed.

In addition, the students have to hand in a lab report about one of the conducted experiments (4-5 pages text). The students demonstrate with the report that they have gained insight in the use of the specific lab equipment and measuring methods and can use analytical tools and methods to analyze and interpret data. The final grade is an average grade from oral examination (90 %) and from the lab report (10 %).

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Basic knowledge in plant production and crop quality.

Content:
Dependence of aroma compounds in vegetal crops on genetic potential and environmental conditions during cultivation of plants. Knowledge of special extraction and analysis methods for aroma compounds. Basics of Human Sensory analysis and application for vegetal crops. Correlation between analytical and sensory methods. The functions of mineral nutrients (N, K, P, S, Ca, Mg, trace elements) in plant metabolism and their impact on plant composition with respect to internal nutritional and processing properties. Effect of the supply of mineral nutrients on external

and internal parameters of plant quality; the influence of the physiological function of nutrients on quality defining products of primary and secondary plant metabolism.

Intended Learning Outcomes:
Upon successful completion of this module, students are able:
- to apply Human Sensory evaluation on the analysis of aroma compounds of vegetal crops;
- to analyze the effects of genetic potential and environmental and plant production factors on aroma relevant plant compounds;
- to analyze how physiological functions of nutrients can affect quality defining products of primary and secondary plant metabolism;
- to evaluate the role of the supply of mineral nutrients (fertilization) on external and internal quality parameters in relation to other exogenous factors;
- to chose appropriate instruments, measuring methods and analytical tools;
- to evaluate the differences of methods for analyzing internal quality parameters by using analytical tools and instruments and interpreting measured data.

Teaching and Learning Methods:
The knowledge will be imparted by PowerPoint-supported lectures to transfer the specialized knowledge about effect of genetic potential and environmental conditions on plant metabolites and the functions of mineral nutrients in plant metabolism. In addition, class discussion of case studies from literature are conducted to intensify the knowledge in relevant topics. In the lab exercise course students will define and solve problems in the chemical analysis of internal quality parameters. They will get practice in laboratory skills by performing experiments and writing a lab report.

Media:
Presentation; lecture, scriptum (Moodle), demonstration and lab practical in labs.

Reading List:
Taiz, L. and Zeiger, E. 2006: Plant Physiology.
Belitz, H.D.; Grosch, W.; Schieberle, P. 2009: Food Chemistry.
Stone, H. and Sidel, J.L. 1993: Sensory Evaluation Practices.
Marschner, H. 1995: Mineral Nutrition of Higher Plants. 2nd edition.
Marschner, P. (ed.) 2012: Marschner’s Mineral Nutrition of Higher Plants. 3rd edition.

Responsible for Module:
Ruth Habegger (ruth.habegger@tum.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Aroma compounds of vegetal plants (Vorlesung, 1,5 SWS)
Habegger R [L], Habegger R

Analysis of quality parameters (Übung, 1 SWS)
Habegger R [L], Habegger R, von Tucher S

Plant mineral nutrition and crop quality (Vorlesung, 1,5 SWS)
Habegger R, von Tucher S
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1696: Crop Genomics | Crop Genomics

Version of module description: Gültig ab winterterm 2022/23

Module Level: Master	**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 written exam (90 min, Klausur) students explain without additional helping material the principles of genetic and bioinformatics strategies of genome analysis in crop plants. They demonstrate that they understand the different layers of genome analysis in crop plants, and that they are able to apply the required genomic and bioinformatics approaches in case studies and judge which methods can be applied in specific cases. They can explain the use of genomic data to analyze genotype-phenotype associations. The grade of the exam will be the final grade of the module.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Successful completion of Bachelor's courses in genetics, molecular biology, plant breeding and statistics is required. Basic knowledge in bioinformatics and skills in R programming or a computer language like Python is highly recommended.

Content:
- Genome organization in crop plants (theory)
- Next generation sequencing and genotyping technologies (theory)
- Genome sequencing and annotation (theory)
- Accessing biological sequence information from databases (theory, exercises)
- DNA sequence comparison and alignment, homology searches (theory, exercises)
- Analysis of genomic sequence data, detection of sequence variants (theory, exercises)
- Analysis of gene expression through genome-wide approaches (theory, exercises)
- Comparative genome analysis (theory)
- Genotype-phenotype association for complex agronomic traits (theory, exercises)
- Application of genomic methods in applied plant breeding programs (theory)

Intended Learning Outcomes:
Upon completion of the module students are able to evaluate molecular methods and the bioinformatic and genetic concepts of genome analysis in crops. They understand the genome organization of crop plants and can explain the concepts of next generation genome sequencing, genome annotation and functional analysis of crop plants. They will be able to access biological sequence information from databases and understand the concept of DNA sequence comparison and alignment. Students will be able to analyze plant genomics data and to use bioinformatic/ statistical approaches for the analysis of genotype-phenotype associations. Successful students can judge which approaches are appropriate for specific situations.

Teaching and Learning Methods:
Theoretical concepts are demonstrated in PowerPoint presentations. Practical application of these concepts will be through computer exercises and tutorials using experimental data sets.
In individual or group work on specific topics with presentations students show their ability to understand and solve problems using current literature and to analyze and evaluate the required methods.
Students are encouraged to attend the weekly talks of the SFB924 seminar series (dates and topics announced under http://sfb924.wzw.tum.de), which are given by national and international experts in plant molecular biology and plant genomics.

Media:
PowerPoint presentations, whiteboard. Lecture slides will be provided online in pdf format.
Computer exercises, application training (analysis of sequence data, genotype-phenotype associations)
Current literature

Reading List:
Brown: Genomes 4. Garland Science, 2017. ISBN 978-0-815-345084
Grotewold, Chappell and Kellogg: Plant Genes, Genomes and Genetics. Wiley-Blackwell, 2015. ISBN: 978-1-119-99887-7

Current literature from specific journals will be announced during the lecture.

Responsible for Module:
Schön, Chris-Carolin; Prof. Dr.sc.agr. 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

WZ1035: Host-Parasite-Interaction | Host-Parasite-Interaction

Version of module description: Gültig ab winterterm 2018/19

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 105	**Contact Hours:** 75

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

Description of Examination Method:
The module is rated via written examination, Klausur, (essay exam, no multiple choice, without the use of learning aids, (100 % of the grade; 90 min). The exam tests the ability of the students to transfer the deep knowledge of principles of molecular plant pathogen interaction on new scientific questions. Students have to show their ability to design experiments suitable to test a given hypothesis from molecular host-parasite interactions. Students have to show in how far they are able to extract scientific progress from original data or experiments presented in the exam.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge of Plant Sciences and Phytopathology at the B.Sc. Level

Content:
In this modul, students reach a deep understanding of plant-pathogen interaction at the molecular level. This comprises pattern-triggered immunity, effector-triggered susceptibility, effector-triggered immunity and translational research. This is not restricted to model plants but extends to crops and fills the gap between basic research and applied plant sciences in breeding and biotechnology for disease resistance. In interactive learning structures with small groups, we train reading and understanding of original literature (Journal Club). In the practical course, we learn real time PCR, plant immune response assays, transient transformation of plants, cell biology of plant defense reactions, etc.

Intended Learning Outcomes:
Education to become a molecular plant pathologist, who is able to judge and design approaches for increasing disease resistance in model and crop plants.
Upon successful completion of the module, students are able

- to understand the molecular basis of plant pathogen interactions in depth.
- to transfer theoretical background and definitions of molecular host parasite interactions.
- to analyze plant immune responses.
- to collect new theoretical knowledge from literature and understand innovative technologies in plant immunity and susceptibility.
- to carry out key molecular methods for quantification of plant immune reactions and disease susceptibility (e.g. real time PCR, reactive oxygen measurement, transient transformation of plants, cell biology of plant defense reactions) in hands-on experience
- to generate experimental design and carry out evaluation of plant disease resistance tests in model and crop plants.

Teaching and Learning Methods:
In the lecture students gain knowledge about theoretical background of plant parasite interactions, which is extracted and focussed by the lecturers from review literature. In the exercise, students practise in small groups key methods for quantification of plant immune reactions and disease susceptibility. They make hands-on experience, practise the use of molecular methods and devices, document their data under guidance and discuss them with group members and supervisors. In the journal club, students are guided in small groups how to critically read original research papers, digest information and present most central findings from a recent original paper.

Media:
PowerPoint

Reading List:
Buchanan 2015: Biochemistry & Molecular Biology of Plants. Review literature provided

Responsible for Module:
Hückelhoven, Ralph; Prof. Dr. rer. nat.

Courses (Type of course, Weekly hours per semester), Instructor:
Host-Parasite-Interaction (Übung, 2 SWS)
Ranf-Zipproth S [L], Engelhardt S, Hückelhoven R, Stam R, Stegmann M

Host-Parasite-Interaction (Vorlesung, 1 SWS)
Ranf-Zipproth S [L], Hückelhoven R

Host-Parasite-Interaction (Seminar, 2 SWS)
Ranf-Zipproth S [L], Hückelhoven R, Engelhardt S, Stam R, Stegmann M
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1545: Human Resource Management in Agriculture and Related Industries | Human Resource Management in Agriculture and Related Industries

Version of module description: Gültig ab winterterm 2018/19

Module Level: Master	**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:
During the written exam (90 min.) students demonstrate their ability to understand human resource management practices, to select and adapt techniques suitable to specific contexts in agriculture and life science industries, to compare and contrast techniques and practices, to evaluate and change selected practices in case applications. Example practices cover the fields of planning the workforce, recruiting, selecting, and training employees, as well as providing feedback to, and evaluating employees, as well as discipline and dismissal, compensation, incentive plans, benefits and services, and workplace diversity. Students analyze exam questions and write up answers in their own words.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
BS Degree. Prior knowledge of basic ideas of economics and management is required; knowledge in strategic management is recommended.

Content:
The course is designed to provide master level students with an understanding of pertinent human resource management practices and how to adapt practices from other industries to farms, horticultural and landscaping operations, in agribusinesses, in the food industry, and in related businesses. Practices relate to planning the workforce, recruiting, selecting, and training employees, as well as providing feedback to, and evaluating employees. Additional practices relate to discipline and dismissal, compensation, incentive plans, benefits and services, and workplace diversity. Examples of current issues as well as laws and regulations provide context for different human resource management practices.

Intended Learning Outcomes:
After successfully completing the module, students are able to accomplish the following:
- understand human resource management practices and their objectives;
- evaluate human resource management practices in use;
- develop and adapt appropriate human resource management practices for specific organizations in agriculture and the life science industries.
- determine the fit of different human resource management practices with different organizational goals and environments.

Teaching and Learning Methods:
Lectures serve to introduce human resource management practices and their objectives.
Video clips serve to illuminate HRM practices and as a basis of discussion of practices. Case descriptions and task sheets are analyzed in small groups and discussed in class to empower students to apply human resource management practices in specific constellations.

Media:
Presentation software, case descriptions and task sheets, discussion facilitation support media, video clips

Reading List:
Dessler, G. (latest edition). Human resource management, Prentice Hall: Upper Saddle River/NJ.

Responsible for Module:
Bitsch, Vera; Prof. Dr. Dr. h.c.

Courses (Type of course, Weekly hours per semester), Instructor:
Human Resource Management in Agriculture and Related Industries (Seminar, 4 SWS)
Bitsch V [L], Bitsch V, Huhn C, Wagner C
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1589: Marker-assisted Selection | Marker-assisted Selection

Version of module description: Gültig ab summerterm 2021

Module Level: Master	**Language:** 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:
In the written examination (Klasur, 120 min) students show without additional material that they are able to explain the basic concepts of marker-assisted selection. They demonstrate that they understand the required statistical and genetic methods. They are able to apply the methods in case studies and place them in the context of a breeding program. They can explain different methods in the analysis of quantitative trait loci. They show that they understand the basic concepts of genomic prediction and selection. They are able to evaluate the efficiency of marker assisted prediction and selection in breeding programs.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Successful Bachelor courses in biology, genetics, plant breeding, biotechnology and applied statistics.

Content:
Technical and genetic principles of molecular markers; building genetic and physical maps; theoretical background and experimental data sets for QTL- and association mapping as well as for genome wide prediction; theoretical background and experimental results for marker-assisted selection

Intended Learning Outcomes:
After successful completion of the module students are able to understand the basic concepts of marker-assisted selection, to apply statistical methods to experimental data sets and to use the respective genetic information in breeding programs. Students will be familiar with different regression methods (e.g. single marker regression, multiple marker regression) in the analysis of quantitative trait loci through linkage or genome wide association mapping. Using regularized

regression, they will be able to perform genomic prediction and selection. Based on examples from the literature they will be able to apply the above mentioned statistical methods to data. Using resampling methods, students will know how to evaluate the efficiency of marker-assisted prediction and selection and will be able to judge under which scenarios they are a useful tool for making breeding decisions.

Teaching and Learning Methods:
The module consists of a lecture, in which the theoretical foundations are developed together with the students through lecture and chalkboard work in dialog. PowerPoint presentations are used to visualize the concepts presented. The theoretical knowledge will be extended in computer exercises through the analysis of experimental data sets.

Media:
PowerPoint presentations, chalkboard
Computer exercises, application training

Reading List:
Lynch and Walsh (1998): Genetics and Analysis of Quantitative Traits; Sinauer Verlag, ISBN 978 0878934812
Risk . A Multidisciplinary Introduction (2014), Chapter 7 by Schön and Wimmer: Statistical Models for the Prediction of Genetic Values, Springer Verlag, ISBN 978-3-319-04486-6

Responsible for Module:
Schön, Chris-Carolin; Prof. Dr.sc.agr. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Marker-gestützte Selektion (Vorlesung, 4 SWS)
Schön C, Mayer M, Ouzunova M, Lanzl T
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1598: Methods in Woody Plant Pathology | Methods in Woody Plant Pathology

Version of module description: Gültig ab summerterm 2015

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/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:
oral examination (15 min), presentation by students on experimental results (15 min); in the presentation the students demonstrate that they are able to present experimental work and results well structured and that they are able to intreprete the results critically. In the oral examinatin they will show their theoretical knowledge on the diverse methods fro pathogen detection and resistance evaluation. They will furthermore show that they are able to choose the appropriate method for new problems. The final grade will be equally calculated from the oral examination and the presentation.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
basics in molecular biology, basics in plant pathology

Content:
Introduction to detection methods:
• biological:
- evaluation of symptoms
- indicator plants
- transmission by (in vitro) grafting or Cuscuta
• immunological:
- antibody, antigen
- ELISA, IGSS
• molecular biological:
- nucleic acids

- PCR (PCR, RT-PCR, qPCR, nested PCR, multiplex PCR, Co-op PCR, immuno PCR, visualization)
- LAMP (LAMP, RT-LAMP, visualization)
- CRCA, RPA, HDA, SDA, NASBA, SMART
- primer design

Resistance evaluation:
• inoculation
• marker assisted selection
• transformation

Intended Learning Outcomes:
The students will be able to apply a diverse spectrum of methods to detect and identify plant pathogens with special respect to diseases in fruit trees.

Teaching and Learning Methods:
lecture, laboratory training

Media:
lecture, laboratory training

Reading List:

Responsible for Module:
Dieter Treutter (dieter.treutter@mytum.de)

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture, Methods in woody plant pathology, 4SWS
Johannes Hadersdorfer (johannes.hadersdorfer@mytum.de)
Dieter Treutter (dieter.treutter@mytum.de)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1667: Model Systems and Crop Quality | Model Systems and Crop Quality

Version of module description: Gültig ab winterterm 2016/17

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

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

Description of Examination Method:
Exam duration 30 min: In the oral examination (90%) at the end of semester the learning outcome is tested by an oral presentation (15 min) and comprehension questions on the treated problems (15 min). In the oral presentation students will, according to scientific practice, treat one specific topic by showing and interpreting the results collected during the experiments, thereby reducing complex aspects on their key message. In a discussion students will need to show their general understanding on the treated topics (e.g.effects of abiotic stress on plant growth). In addition students will write a report about one specific ecophysiological or laboratory method applied in the experiments (10%).

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Basic knowledge in plant nutrition

Content:
A scientific experiment on a current topic in plant nutrition will be planned, conducted and evaluated. Examples for possible topics are: plant growth and chemical composition as affected by abiotic stress (drought, salinity, nutrient deficiency or toxicity), adaptation or mitigation strategies to climate change or nutrient - environment interactions.
The content includes the theoretical background of the problems as well as theoretical and practical aspects on the design of such experiments and adequate methods for data collection (e.g. nutrient analyses in plants and soils, ecophysiological and non-destructive methods).

Intended Learning Outcomes:
At the end of the modul students are able

1. to perform a basic planning of experiments in the area of plant nutrition, to basically select appropriate analytical methods and to perform an adequate data documentation and evaluation;
2. to assess the suitability of analytical methods for the specific purpose;
3. to apply the theoretical background knowledge (e.g. the causes and consequences of abiotic stress to plants)

Teaching and Learning Methods:
Lectures, lab practicals, work in groups

Media:
Presentation, practical analyses

Reading List:
Marschner, H., 1995: Mineral Nutrition of Higher Plants, Academic Press London, 2nd Edition.

Responsible for Module:
von Tucher, Sabine; Dr. agr.

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

Lecture and Practical
1 and 3 SWS

Sabine von Tucher
TUM
sabine.tucher@mytum.de

Yuncai Hu
TUM
hu@mytum.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1563: Organizational Behavior, Theory and Development | Organizational Behavior, Theory and Development

Version of module description: Gültig ab winterterm 2014/15

Module Level: Master	**Language:** 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:
Prüfungsdauer (in min.): 30.
The course grade consists of two parts: 25% term paper (with presentation and discussion) and 75% case study grade; the case study grade is based on the case memos (50% of overall), and ability to discuss the assigned case questions as well as to apply the underlying concepts (25% of overall) Justification: In the term paper, students demonstrate their ability to research and critically evaluate a current organizational concept. Through the case memos, students demonstrate their ability to select suitable theoretical concepts and apply them to organizational challenges. Through the discussion of case questions, students demonstrate their ability to contrast the strengths and limitations of different perspectives on organizations, to understand the impact of various organizational management options on the individual, group, and organizational level, to develop awareness of ethical challenges and options, to understand models of organizational change and their action implications, and to apply and adapt organizational management and development practices to a specific context in the agricultural and food industries.

Repeat Examination:

(Recommended) Prerequisites:
Advanced course. Prior knowledge of economics and management concepts is required. Knowledge of basic concepts of organizational behavior and management skills is required. Successful completion of a basic organization and management course on MSc. level strongly recommended.

Content:
Key concepts in organizational behavior, theory, and development: perspectives on organizations, their strengths and limitations; the role of the individual, the group, and the organization in a high

performance environment; business ethics and ethical conduct; adapting to current challenges and changes in the institutional environment; understanding organizational change, facilitating change processes, and overcoming barriers.

Intended Learning Outcomes:
Selecting and applying suitable concepts of organizational behavior, theory, and development depending on organizational challenges and context; contrast the strengths and limitations of different perspectives on organizations; predict the impacts of various organizational management options on the individual, group, and organizational level; identify ethical challenges and options; structure organizational change processes, apply models of organizational change, and predict their action implications; adapting organizational management and development practices to specific contexts in the agricultural and food industries.

Teaching and Learning Methods:
Seminar: case study based class discussions and presentations, group work based on cases and students' experiences, and assignments; student presentation, discussion, and report of a current organizational topic.

Media:
Reading assignments; case descriptions, presentations, and discussions, supported by flipchart and other moderation media

Reading List:
Selected chapters from
Brown, Donald R. (latest edition). An Experiential Approach to Organization Development, Prentice Hall: Boston.
Daft, Richard L. (latest edition). Organizational Theory and Design. South-Western/Cengage Learning.
Kreitner, Robert and Kinicki, Angelo (latest edition). Organizational Behavior. McGraw-Hill Irwin.
Morgan, Gareth 2006. Images of Organization. Updated ed., Sage: Thousand Oaks/CA.

Responsible for Module:
Vera Bitsch bitsch@tum.de

Courses (Type of course, Weekly hours per semester), Instructor:
People in Organizations: Managing Change and Sustainability in Agribusiness and Food Industry (WZ1563, WI001205) (Seminar, 4 SWS)
Bitsch V [L], Bitsch V, Huhn C, Wagner C
For further information in this module, please click campus.tum.de or here.

Module Description

WZ2480: Plant Developmental Genetics 2 | Plant Developmental Genetics 2

Version of module description: Gültig ab winterterm 2019/20

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 4	**Total Hours:** 120	**Self-study Hours:** 60	**Contact Hours:** 60

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

Description of Examination Method:
In the oral examination (30 min.) students explain without additional helping material principles of plant developmental genetics, describe experimental strategies of plant developmental genetics and evaluate the relevance of plant developmental genetics for horticulture and plant breeding.
The grade of the exam will be the final grade of the module.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Genetics (WZ0703). Plant Developmental Genetics I (WZ0305). A basic understanding of genetics, molecular biology and cell biology is required.

Content:
- photomorphogenesis
- flowering time control
- floral meristem identity
- floral organ identity
- floral organogenesis
- gametophyte, apomixis
- fertilization process
- parental control of embryogenesis/seed development

Intended Learning Outcomes:
After successful completion of the module students are able to understand the basic concepts of plant developmental genetics and to evaluate their relevance for problems in horticulture and plant breeding.

Teaching and Learning Methods:
The lecture provides the theoretical background and concepts. During the exercises, in individual or group work on specific selected original literature with presentations students show their ability to understand the concepts and to critically analyse and evaluate the obtained scientific models.

Media:
PowerPoint presentations, chalkboard
Slides will be provided online in pdf format. Taped recordings of the lectures will be provided online as audio- and videopodcasts.
Current literature,

Reading List:
Taiz et.al. Plant Physiology and Development 2015 6th edition, Oxford University Press; Smith et al. Plant Biology 2010, Garland Science.
Current literature from specific journals will be announced during the lecture.

Responsible for Module:
Schneitz, Kay Heinrich; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Entwicklungsgenetik der Pflanzen 2 (Vorlesung, 2 SWS)
Schneitz K [L], Schneitz K

Journal Club Entwicklungsgenetik der Pflanzen (Seminar, 2 SWS)
Schneitz K, Torres Ruiz R
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1185: Plant Epigenetics and Epigenomics | Plant Epigenetics and Epigenomics

Version of module description: Gültig ab winterterm 2019/20

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer 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:
The examination consists of a presentation (20 min) followed by discussion (10 min). The presentation should summarize and interpret the results obtained from analyzing published epigenomic datasets using the computational skills aquired during the Computer Practical sessions. The presentation is a means to measure the student's ability to understand a technical/scientific subject, to analyze and evaluate facts and factors of influence, to summarize the subject and present it to an audience, and to conduct a discussion about the presented subject

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Basic knowledge of genetics, cell biology, statistics

Content:
The course will cover:
- Components and functions of the plant epigenome: DNA methylation, histone modifications
- Measuring epigenomes: array-based and NGS based bulk and single cell technologies
- Analyzing plant epigenomic data: Array and NGS based computational tools for bulk and single cells
- Plant epigenome and environmental variation
- Plant epigenome and genetic variation
- Epigenetic inheritance in plants: Mitotic and meiotic inheritance
- Current perspectives on the agricultural and evolutionary implications of epigenetic inheritance in pl

Intended Learning Outcomes:
Students will be able to:
- Interpret the molecular components of epigenomes
- Interpret functions of epigenomes
- Identify the sources of population level epigenomic variation
- Explain modern measurement technologies
- Distinguish the conceptual background of different computational tools
- Apply computational tools to epigenomic data
- Analyze the implications of epigenetic and epigenomics
- Carry out presentation skills

Teaching and Learning Methods:
The following teaching methods will be used:
- Lectures: The goal of the lectures is to provide an in-depth overview of the main concepts, approaches and research questions in plant epigenetics and epigenomics.

- Computer tutorial: The goal of the computer tutorials is to reinforce the lecture contents with hands-on experience. The main aims are: 1) to get hands-on experience with the type of epigenomic datasets that is routinely generated in this field; 2) to get hands-on experience with software tools for the analysis of epigenomic datasets; 3) to be able to evaluate the output from these software tools, and to use the output as a way to answer concrete biological research questions.

- Seminars: The goal of the seminars is to discuss recent scientific literature in plant epigenetic and epigenomics . The aim is to demonstrate how the concepts, approaches and research questions presented in the course provide a means to decode complex scientific articles in this field.

Media:
PowerPoint presentations, software practicals

Reading List:
Hand-outs

Responsible for Module:
Johannes, Frank; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Plant Epigenetics and Epigenomics (Vorlesung, 3 SWS)
Johannes F

Plant Epigenetics and Epigenomics - Computer Practical (Praktikum, 2 SWS)
Johannes F, Hazarika R
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1719: Practical Course: Analysis of Epigenomic Data | Practical Course: Analysis of Epigenomic Data

Version of module description: Gültig ab summerterm 2017

Module Level: Master	**Language:** 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:
Regular and active particpation in the esearch project is expected. Students will be evaluate on the following criteria:
1. Demonstration of practical skills
2. Presentation of results in work discussion meetings
3. Presentation of results in final presentation
4. Written summary of the final results
In the presentations and the written summary, students should demonstrate their ability to structure their thinking and research activities; highlight major aspects of the research questions and results, and interprete them in the context fo the broader research topic

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge of computer system

Content:
Epigenetic modifications, such as DNA methylation or histone modifications, have a central role in the regulation of gene expression and in the preservation of genome integrity. Next Generation Sequencing (NGS) technologies now allow us to measure the genome-wide patterns of various epigenetic modifications at unprecedented resolution. These technologies have opened up novel research avenues in basic and applied plant biology, including studies of development, stress response and natural variation.
In the framework of this practical course students will work under close supervision on current research topics in plant epigenetics and epigenomics. Students will be aquainted with high-throughput sequencing technologies, data files, various software packages, and low level

programming tasks. Students will aquire insights into the broader research topic through personal studies of relevant litature.

Intended Learning Outcomes:
This practical course will enable students to work independently on realistic research questions in the field of plant epigenetics and epigenomics.At the end of this course, students will be able to:
1) Distunguish mainstream measurement approaches such as chromatin immunoprecipitation followed by sequencing (ChIP-seq) and whole genome bisulphite sequencing (WGBS-seq) 2) understand the structure of the data files produced by sequencing machines
3) apply a number of software tools for analyzing ChIP-seq and WGBS-seq data
4) interpret the output from the data analysis
5) query the results to answer specific biological questions

Teaching and Learning Methods:
Teaching techniques: Computer practical, individualized instructions in the analysis of biological data, critical discussion of analysis results with experienced supervisors and members of the research group. Learning tasks: Literature studies, hands-on computer-oriented tasks, preparation of research summaries in the forms of presentations and a written report.

Media:
Case studies

Reading List:
None

Responsible for Module:
Prof. Johannes f.johannes(a)tum.de

Courses (Type of course, Weekly hours per semester), Instructor:
Übung
Forschungspraktikum: Analysis of epigenomic data
10

Frank
Prof. Johannes
TUM, Fachgebiet Populations Epigenetik und Epigenomik
f.johannes(a)tum.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ2400: Practical Course: Computing for Highthroughput Biology | Forschungspraktikum Computeranwendungen für Hochdurchsatz-Biologie

Version of module description: Gültig ab winterterm 2020/21

Module Level: Master	**Language:** German/English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 10	**Total Hours:** 300	**Self-study Hours:** 150	**Contact Hours:** 150

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

Description of Examination Method:
In the course, students work on large-scale genomic data sets. The scientific problem, the applied methods, the results and the interpretation and discussion of the results will be documented in a scientific report (ca. 20 pages) which will be graded.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge of computer systems. Familiarity with UNIX/Linux and basic programming skills in R or Python are an advantage.

Content:
Agricultural biosciences demand computational skills and in depth knowledge of biological data. During the course, students will practice with some common data analysis methods of high throughput technology, such as next generation sequencing, gene expression analysis, high-throughput genotyping in individual projects. They will gain knowledge on how to utilize existing biological databases in their research and how to interpret their own results in the context of current literature.

Intended Learning Outcomes:
In individual research projects, students will become familiar with computational strategies for the analysis of high dimensional data. Upon completion of this module, students are able to handle large datasets and process them with appropriate tools using programming languages like R or Python. They will be able to analyze datasets and use suitable tests for evaluating the plausibility of the data and to do quality filtering. They will be able to apply custom pipelines for data analysis.

Depending on the specific project this will include the use of public databases, text manipulation with R or Python, gene expression analysis with bioconductor R, sequence analysis with blast, vmatch, Clustalw, BWA, genome visualization with GBrowse and Next Generation Sequencing workflows. Students will be able to test the significance of the results and to interpret them in the context of current literature.

Teaching and Learning Methods:
The advisors will provide experimental data from current research projects or from public datasets. In computer exercises, students will learn to write programming scripts for handling and analyzing the data. Results will be discussed with the advisors and interpreted using current literature.

Media:
Case studies, computer exercises.

Reading List:
Project-specific current literature will be provided for each project.

Responsible for Module:
Schön, Chris-Carolin; Prof. Dr.sc.agr. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Forschungspraktikum Computeranwendungen für Hochdurchsatz-Biologie (Forschungspraktikum, 10 SWS)
Avramova V, Lanzl T, Urzinger S, Mayer M
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1571: Project Mangement in Horticultural Plant Sciences | Project Mangement in Horticultural Plant Sciences

Version of module description: Gültig ab summerterm 2015

Module Level: Master	**Language:** 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 consists of presentation of the scientific poster (50%) in a 10minute talk with subsequent discussion (30%), regular discussions with the assigned tutor (research assistant) about the progression of the project and the next steps to take (20%). In the presentation and the discussion the students will demonstrate that they are able to select (1) the appropriate literature data bases for solving a problem in horticultural plant sciences and (2) the appropriate methods for statistically evaluating further novel sets of experimental data.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge in plant sciences and data evaluation

Content:
The module intends to support structuring, organizing and realizing practical scientific experiments and evaluating the results. Each student will work on an individual scientific problem in horticulture which is related to the master's thesis. In a seminar part, each participant will introduce his particular subject including basic literature data and also outlining the scientific frontiers to the auditory in a first presentation. A second presentation of each participant will include an outline of the experimental design for problem solving. Finally, the students will present their experimental results as a scientifc poster. All these presentations will be discussed in the auditory. This seminar is accompanied by a lecture about (1) the advanced use of scientific literature databases, (2) possible structures of scientific publications, (3) data acquisition and statistical analysis including methods-secure application of Excel (Pivot) and statistics programs (Minitab, SPSS) for data analysis (distribution tests, regression analysis, ANOVA);

Intended Learning Outcomes:
After successfully participating in this module, students are able to: - prepare a literature survey about a given scientific problem using the appropriate scientific literature database; - design and organize an experimental approach for solving the given problem; - use tools for data evaluation and to apply them to various sets of data; - to evaluate the results of statistical methods with respect to the interpretation of experimental data; - create the general structure of a scientific paper including correct citation; - prepare presentations and hold them in an optimized presentation manner. Core objective is to be able to implement these basic operations of the scientific practice and transfer them effectively to their master thesis.

Teaching and Learning Methods:
Depending on the module block lectures, practice sessions, tutorials and workshops are offered.

Media:
Multimedia presentation (Powerpoint/Keynote), Poster

Reading List:
References are given in the individual module blocks.

Responsible for Module:
Treutter Dieter dieter.treutter@wzw.tum.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lectures, excercises, seminar
4 SWS
Goldner Katharina
katharina.goldner@tum.de

Michaelis Sybille
hortsci@wzw.tum.de

Rühmann Susanne
susanne.rühmann@wzw.tum.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1578: Project Management in Molecular Plant Biotechnology | Project Management in Molecular Plant Biotechnology

Version of module description: Gültig ab winterterm 2019/20

Module Level: Master	**Language:** 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:
The examination consists of a bipartite presentation (20 min + 20 min) followed by a group discussion (10 min + 10 min). By presenting their own research project (part 1) the student's ability is tested to summarize the scientific background, to formulate specific research questions, to present the relevant results and to hold a discussion about the key conclusions. By presenting and discussing the key findings of a chosen scientific publication (part 2) the student's skills are analysed to evaluate other peoples work in a constructive manner. The quality of the two presentation parts will be evaluated and equally weighted.

Repeat Examination:

(Recommended) Prerequisites:
Basics in genetics, molecular biology and biochemistry. It is recommended to enrol the course in parallel to the master thesis work.

Content:
The key aim of the module is to equip master level students with a basic understanding of the research process in the field of Molecular Plant Biotechnology, particularly to establish a relevant research question, to develop experimental strategies, to conceive a realistic research plan, to perform experiments applying good laboratory practice, to assemble and interpret data at a publication-quality level and to critical discuss these data with peers. The course consists of two parts: 1) The students analyze, present and critically discuss an actual relevant publication in the field of Molecular Plant Biotechnology 2) They will develop and present their own research project, carried out in one of the participating labs. Moreover, the students will participate in other student’s presentations and will be able to contribute ideas in discussions following the presentation. They will learn how to critically evaluate their own work and those of others.

Intended Learning Outcomes:
At the end of the module students are able to:
- extract relevant data from a scientific publication in the field of Plant Molecular Biology/Plant Biotechnology;
- assemble these data in a presentation;
- orally present the data to an auditorium;
- discuss the data and scientific conclusions with teachers and colleagues;
- conceive a project proposal in the area of Molecular Plant Biotechnology;
- structure it in specific objectives;
- design a research plan based on a reasonable combination of experimental approaches;
- present and discuss the proposal with peers.

Teaching and Learning Methods:
To develop required skills to present their own research project as well as to critically discuss published studies with peers, each student will prepare and hold a bipartite multimedia-supported presentation of their own research project (master thesis) and of one recent, relevant scientific publication followed by a constructive discussion and feedback by the other course participants.

Media:
Multimedia presentation (PowerPoint/Keynote), relevant publications.

Reading List:
At the Bench: A Laboratory Navigator, K. Parker; Cold Spring Harbor Laboratory Press, 2005
Preparing and Delivering Scientific Presentations; J. Giba and R. Ribes, Springer, 2011

Responsible for Module:
Sieberer, Tobias; Dr. nat. techn.

Courses (Type of course, Weekly hours per semester), Instructor:
Wissenschaftliches Arbeiten in der Pflanzenbiotechnologie (Seminar, 4 SWS)
Poppenberger-Sieberer B, Sieberer T
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1584: Quantitative Genetics and Selection | Quantitative Genetics and Selection

Version of module description: Gültig ab summerterm 2021

Module Level: Master	**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 written examination (Klausur, 120 min) students show without additional material that they are able to explain the basic concepts of quantitative genetics and population genetics and their relevance for breeding. They demonstrate their ability to use the acquired knowledge for the design of optimized breeding strategies. The grade of the exam will be the final grade of the module.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Successful Bachelor courses in applied statistics (e.g. module Statistische Methoden)

Content:
Population genetics: genetic constitution of populations, selection and mutation
Quantitative genetics: Inbreeding and heterosis, epistasis, phenotypic and genetic variance, resemblance between relatives, heritability, genotype-environment interaction
Selection theory: response to selection

Intended Learning Outcomes:
After successful completion of the module, students are able to understand the basic concepts of quantitative genetics and to evaluate their relevance for problems in plant breeding. They can explain important population genetic concepts such as the Hardy-Weinberg Law, understand the concepts of linkage and linkage disequilibrium and how they can be estimated in experimental populations. The students become familiar with the theoretical concepts underlying breeding values and combining ability and their application in estimating heritability. They can identify and quantify resemblance between relatives. They are able to apply these concepts to selection theory for the optimization of breeding programs.

Teaching and Learning Methods:
The module consists of a lecture, in which the theoretical background and concepts are developed through PowerPoint presentations and chalkboard work. The analysis of experimental data sets in computer exercises extends the theoretical knowledge.

Media:
PowerPoint presentations, chalkboard
Computer exercises, application training

Reading List:
Falconer and Mackay (1995) Introduction to quantitative genetics; Pearson Education Limited, ISBN: 978-0582243026, 4th edition

Lynch and Walsh (1998): Genetics and Analysis of Quantitative Traits; Sinauer Verlag, ISBN 978 0878934812

Responsible for Module:
Schön, Chris-Carolin; Prof. Dr.sc.agr. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Quantitative Genetik und Selektion (Vorlesung, 4 SWS)
Schön C, Lanzl T
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1599: Research Methods and Economics Research Project (IMaHS) | Research Methods and Economics Research Project (IMaHS)

Version of module description: Gültig ab winterterm 2014/15

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

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

Description of Examination Method:
Prüfungsdauer (in min.): 30.
The course grade consists of two parts: 50% project report and 50% in-class grade. The in-class grade consists of equal parts each, proposal presentation, project results presentation, peer review of another student's proposal, peer review of another student's project results, and discussion of applications of economic concepts.
Justification: Students demonstrate their ability to apply economic concepts through class discussions and development of project ideas.
Students demonstrate their ability to develop an economics research projects through the stages of proposal presentation, result presentation, and project report.
Students demonstrate their ability to evaluate other researchers’ proposals and results in a constructive manner through presentations of reviews.
Students demonstrate their ability to manage resources, and deadlines through timely submission of the enumerated tasks in stages throughout their research projects.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
The course does not have formal prerequisites. Prior knowledge of basic ideas of economics and management is useful.

Content:
The module provides master level students with an advanced understanding of the research process, its quality criteria, and the application of economic concepts to questions of food and agriculture. Key economic ideas are applied to everyday questions in class discussions based on economic texts, podcasts, and others. The development, execution, publication, and review of

disciplinary and interdisciplinary research is explained in lectures and carried out by each student from beginning to end.
Steps include developing project ideas and research questions; using peer-reviewed literature to frame a student project; designing research plans with the appropriate methods and suitable techniques of data collection; structuring, preparing, presenting, and critically reviewing research proposals; data collection, data analysis, and data presentation; discussion and conclusions based on reflecting own empirical research in the light of the literature; disciplinary, professional, and ethical quality criteria of research in economics and management.

Intended Learning Outcomes:
Students are able to apply economic ideas to questions related to food and agriculture in everyday life.
Students are able to develop and execute an economic research project in the field of agriculture, horticulture, and food.
Specifically, students are able to develop a project idea, develop a research question and objectives based on the project idea and the related scientific literature, and create a research plan, including the suitable combination of research methods and techniques; defend a research proposal based on the research plan.
Students are able to evaluate other (student) researchers' proposals and present such evaluations in a suitable form, orally.
Furthermore, students are able to apply their research plan through data collection, data analysis, and presentation of research results, in oral and written form; and are able to evaluate other (student) researchers' research process, results, and conclusions.
Students are able to manage resources and deadlines.

Teaching and Learning Methods:
Lectures, class discussions, and guided student project development and project evaluation (project proposal, proposal review, project results, results review, and research report).

Media:
Presentation slides, websites, articles and short texts, multi-media (podcasts, video clips), student presentations, and reviews.

Reading List:
Hartford, Tim (latest edition). The Undercover Economist. Random House: New York.
O'Leary, Zina (latest edition). The Essential Guide to Doing Your Research Project. Sage: Los Angeles.
Committee on Science, Engineering, and Public Policy,
National Academy of Sciences, National Academy of
Engineering, and Institute of Medicine (latest edition). On Being a Scientist: A Guide to Responsible Conduct in Research.

Responsible for Module:
Vera Bitsch bitsch@tum.de

Courses (Type of course, Weekly hours per semester), Instructor:
Research Methods and Economic Research Project (WZ1559, WZ1674) (Seminar, 4 SWS)
Bitsch V [L], Bitsch V, Carlson L, Wagner C
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1577: Research Project 'Biotechnology of Horticultural Crops' | Research Project 'Biotechnology of Horticultural Crops'

Version of module description: Gültig ab winterterm 2019/20

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 10	**Total Hours:** 300	**Self-study Hours:** 150	**Contact Hours:** 150

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

Description of Examination Method:
The students conduct a six-week research project in the lab. The work-schedule can be adjusted to the curriculum of the students. After the practical work, a report (approximately 15 to 20 pages) has to be prepared and handed in usually within 4 weeks after the laboratory work has been concluded. By preparing a report the students demonstrate the ability to summarise the theoretical background and key aims of the performed experiments and to present the acquired results in a concise and coherent manner and to interpret and discuss the experimental data in the context of available literature. The grade of the report is based on the accuracy and correctness of the results (50%) and the quality of presentation and evaluation of the data (50%), particularly the description of the theoretical background, presentation of raw data, calculations, application of statistical tests and interpretation and discussion of the results.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge in plant molecular biology, biochemistry, genetics and development. Practical experience with basic lab working techniques such as pipetting and working under sterile conditions. Successful completion of the lecture(s) Crop Biotechnology and/or Plant Biotechnology.

Content:
The students work on a research project in the lab on one of the following topics:
a) plant hormone signalling
b) impact of environmental cues on plant growth and development
c) heterologous expression of plant proteins
Methods and techniques applied in the framework of the course will depend on the individual project and may include: cloning, plant transformation, PCR, qPCR, Western blot analysis, protein

expression and purification, assays for enzymatic activity, EMSA, chromatin IP, fluorescence and electron microscopy, phenotypic characterisation of plants, cold or heat stress assays, ion leakage assays, dose response assays and quantification of metabolites and nutrients by chromatographic and spectroscopic techniques. Statistical methods are applied for data evaluation. Many of these techniques are applicable to other (non-plant) organisms.

Intended Learning Outcomes:
Upon completion of this module students:
- have acquired competence in several laboratory techniques related to biotechnology in horticultural crops including cloning of genes, heterologous expression of plant proteins and generation and analysis of transgenic plants
- can perform experiments in an efficient, time saving manner
- can evaluate data and apply statistical tests
- are able to design experiments with all necessary controls and interpret the results
- have increased their competence in scientific reading and writing
- can display scientific data in publication quality

Teaching and Learning Methods:
Close theoretical and practical supervision combined with autonomous lab work. Reading original research articles. Reading and application of laboratory protocols. Discussion of the protocols and the underlying principles of the experiments. Writing of a laboratory book. Written documentation of the experiments and results.

Media:
Oral instructions, lab protocols, relevant scientific publications.

Reading List:
The literature depends on the individual project and will be provided ahead of the course.

Responsible for Module:
Rozhon, Wilfried; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Forschungspraktikum Biotechnologie gartenbaulicher Kulturen (Forschungspraktikum, 10 SWS)
Poppenberger-Sieberer B, Dündar G, Sieberer T
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1575: Research Project 'Chemical Genetics' | Research Project 'Chemical Genetics'

Version of module description: Gültig ab winterterm 2019/20

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 10	**Total Hours:** 300	**Self-study Hours:** 150	**Contact Hours:** 150

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

Description of Examination Method:
The students conduct a six-week research project in the lab. The work-schedule can be adjusted to the curriculum of the students. After the practical work, a report (approximately 15 to 20 pages) has to be prepared and handed in usually within 4 weeks after the laboratory work has been concluded. By preparing a report the students demonstrate the ability to summarise the theoretical background and key aims of the performed experiments and to present the acquired results in a concise and coherent manner and to interpret and discuss the experimental data in the context of available literature. The grade of the report is based on the accuracy and correctness of the results (50%) and the quality of presentation and evaluation of the data (50%), particularly the description of the theoretical background, presentation of raw data, calculations, application of statistical tests and interpretation and discussion of the results.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge in plant molecular biology, biochemistry, genetics and chemistry. Practical experience with basic lab working techniques such as pipetting and working under sterile conditions. Successful completion of the lecture(s) Crop Biotechnology and/or Plant Biotechnology.

Content:
Chemical Genetics is a novel interdisciplinary approach in which small molecules are used to identify proteins responsible for the expression of a specific phenotype (forward chemical genetics) or to affect the function of a specific protein and assess the morphological, physiological and molecular consequences within the organism (reverse chemical genetics). Chemical genetic approaches are not only useful in basic research questions, they can also directly lead to the development of drugs and agrochemicals.

This module will teach students a subset of the following techniques by participating in a research project in the lab:
- Storage and handling of a chemical library;
- Design of a chemical genetic screen;
- Set up of a chemical genetic screen in conformity with the required quality standards;
- Phenotype-based small molecule screening in Arabidopsis thaliana
- Phenotype-based small molecule screening horticulturally relevant plant species;
- Expression marker-based small molecule screens;
- Hit confirmation assays;
- Dose response assays;
- Structure/function analysis using cheminformatic methods;
- Establishment of an in vitro assay to test ligand-target interaction.

Intended Learning Outcomes:
Upon completion of this module students are able:
- to understand the principles of chemical genetic research approaches;
- to assess for which scientific questions a chemical genetic approach might be helpful;
- to plan and to carry out basic chemical genetic experiments in plants according to the required quality standards;
- to interpret and evaluate the results obtained in chemical genetic screens in a written report.

Teaching and Learning Methods:
Close theoretical and practical supervision combined with autonomous lab work enables the student to understand and apply basic experiments in Plant Chemical Genetics. By discussing lab protocols the student analyses the underlying methodological principles of the experiments. By reading original research articles the student learns to assess quality standards for chemical genetic approaches. By writing a research report the student learns to summarize the obtained results and discusses it in the context of relevant literature.

Media:
Oral instructions, lab protocols, relevant scientific publications.

Reading List:
Plant Chemical Genomics: Methods and Protocols (2014) G. R. Hicks and S. Robert, Humana Press;
Plant Chemical Biology (2014) D. Audenaert and P. Overvoorde, John Wiley & Sons

Responsible for Module:
Sieberer, Tobias; Dr. nat. techn.

Courses (Type of course, Weekly hours per semester), Instructor:
Forschungspraktikum Chemische Genetik (Forschungspraktikum, 10 SWS)
Poppenberger-Sieberer B, Ramirez V, Sieberer T
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1718: Research Project 'Horticultural Economics and Management' | Research Project 'Horticultural Economics and Management'

Version of module description: Gültig ab summerterm 2017

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 10	**Total Hours:** 300	**Self-study Hours:** 150	**Contact Hours:** 150

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

Description of Examination Method:
The assessment type of the module is a graded research paper (100%). The content of the research paper is also communicated in a scientific presentation. With the research paper, students demonstrate the ability to develop a horticultural economics or management research project at an advanced level. The students progress through the stages of proposal, revision of proposal, data collection and analysis, results, revision of result presentation, reflecting results in the light of the relevant scientific literature and drawing conclusions. Students show their ability to solve problems independently and seek support, when necessary.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Knowledge of basic concepts of economics and management is required, demonstrated, e.g., by successful completion of MSc level course in economics or management; experience with guided research in economics and management is required, demonstrated, e.g., by successful completion of a bachelor’s thesis in the field or a research course, such as Research Methods and Economic Research Project.

Content:
The module provides master level students with an advanced understanding of the research process in economics and management applied to the specific context of horticulture and related industries.
Steps of the project include
- developing the project idea and the corresponding research questions;
- using peer-reviewed literature to frame the project;

- designing research plans with the appropriate methods and suitable techniques of data collection;
- data collection and data analysis;
- data presentation;
- discussion and conclusions based on reflecting own empirical research in the light of the literature; as well as disciplinary, professional, and ethical quality criteria of research in economics and management applied in the specific context of biobased industries.

Intended Learning Outcomes:
After successfully completing the module, students are able to develop and execute a research project independently. Specifically, students are able to
- develop a project idea
- identify relevant scientific literature
- develop a research question and objectives based on the project idea and the related scientific literature
- create a research plan, including the suitable combination of research methods
- defend a research proposal based on the research plan
- apply their research plan through data collection, data analysis
- present research results in oral form
- write a research report.

Teaching and Learning Methods:
The course Research Project Horticultural Economics and Management has an independent study format. The supervised independent scientific work in the area of horticultural economics and management serves to allow students to hone their independent research skills in preparation of a master thesis. While the format allows students to make mistakes and learn from their mistakes, the guidance provided serves to avoid lengthy detours, which would impede timely completion of the students’ study program.

Media:
Selected original papers; presentation software; flipcharts or similar for guided brainstorming and structuring.

Reading List:
O'Leary, Zina (latest edition). The Essential Guide to Doing Your Research Project. Sage: Los Angeles.

Responsible for Module:
Prof. Dr. Vera Bitsch

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

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

Module Description

WZ1697: Research Project 'Metabolite Analyses in Crops' | Research Project 'Metabolite Analyses in Crops'

Version of module description: Gültig ab winterterm 2019/20

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 10	**Total Hours:** 300	**Self-study Hours:** 150	**Contact Hours:** 150

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

Description of Examination Method:
The students conduct a six-week research project in the lab. The work-schedule can be adjusted to the curriculum of the students. After the practical work, a report (approximately 15 to 20 pages) has to be prepared and handed in usually within 4 weeks after the laboratory work has been concluded. By preparing a report the students demonstrate the ability to summarise the theoretical background and key aims of the performed experiments and to present the acquired results in a concise and coherent manner and to interpret and discuss the experimental data in the context of available literature. The grade of the report is based on the accuracy and correctness of the results (50%) and the quality of presentation and evaluation of the data (50%), particularly the description of the theoretical background, presentation of raw data, calculations, application of statistical tests and interpretation and discussion of the results.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge in plant molecular biology, biochemistry, genetics and development. Practical experience with basic lab working techniques such as pipetting and working under sterile conditions. Successful completion of the lecture(s) Crop Biotechnology and/or Plant Biotechnology.

Content:
The students work on a research project independently in the laboratory. The project will focus on quantification of primary metabolites, secondary metabolites and/or nutrients in crop plants and factors/methods for altering the metabolite composition of crops.
Methods and techniques applied in the framework of the course will depend on the individual project and may include:

- methods for sample preparation including extraction, liquid-liquid extraction and solid phase extraction
- chemical derivatisation of analytes
- chromatographic techniques including HPLC, UHPLC, GC, TLC, ion chromatography and column chromatography
- spectroscopic methods including UV/VIS, fluorescence and IR spectroscopy and flame photometry
- mass spectrometry
- chiroptical methods including optical rotation dispersion and circular dichroism
- luminometry (chemiluminescence and biolominescence)
- chemical synthesis of compounds
- stable isotope labelling of compounds
- application of statistical statistic methods are applied for data evaluation

Intended Learning Outcomes:
Upon completion of this module students:
- have acquired competence in several laboratory techniques related to metabolite analysis in cops
- can apply chromatographic and spectroscopic methods
- can perform experiments in an efficient, time saving manner
- can evaluate data and apply statistical tests
- are able to design experiments with all necessary controls and interpret the results
- have increased their competence in scientific reading and writing
- can display scientific data in publication quality

Teaching and Learning Methods:
Close theoretical and practical supervision combined with autonomous lab work. Reading original research articles. Reading and application of laboratory protocols. Discussion of the protocols and the underlying principles of the experiments. Writing of a laboratory book. Written documentation of the experiments and results.

Media:
Oral instructions, lab protocols, relevant scientific publications.

Reading List:
The literature depends on the individual project and will be provided ahead of the course.

Responsible for Module:
Rozhon, Wilfried; 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

WZ2401: Research Project 'Molecular Plant Breeding' | Forschungspraktikum Molekulare Pflanzenzüchtung

Version of module description: Gültig ab winterterm 2019/20

Module Level: Master	**Language:** German/English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 10	**Total Hours:** 300	**Self-study Hours:** 150	**Contact Hours:** 150

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

Description of Examination Method:
The examination consists of a project report (approx. 15-20 pages), which is to be submitted at the end of the module and is graded. The report contains a short introduction to the topic, the scientific research questions, the applied material and methods, the results and a discussion of the results in the context of current literature.

Repeat Examination:

(Recommended) Prerequisites:
Basic knowledge in molecular genetics and plant breeding. Previous practical experience with molecular techniques and/or handling of plants is an advantage.

Content:
The individual projects that students will work on encompass current topics of plant breeding and address different aspects of ongoing research projects. The projects cover the acquisition of scientific methods and comprise molecular genetic laboratory and/or modern phenotyping methods for agronomic traits. Depending on the individual project, different molecular techniques are applied (e.g. DNA extraction from plant material, PCR, DNA cloning and sequencing, analysis of molecular markers, gene expression analysis). We also offer topics related to drought stress in field or greenhouse experiments with a strong focus on application in crop plants, where physiological and agronomic traits are assessed. In projects with a focus on phenotyping, students will learn how to plan and conduct field or greenhouse experiments and how specific phenotypes are measured. During the project, the appropriate scientific analysis and interpretation of the data will be addressed, which includes e.g. statistical data analysis, mapping of genes/QTL, characterization of genes, literature work.

A list of current projects is available at www.wzw.tum.de/plantbreeding. Upon agreement own topics can be suggested.

Intended Learning Outcomes:
In the research project "Molecular Plant Breeding" the students will learn to design experiments in the lab or greenhouse/field in individual case studies. They gain experience in planning and conducting the experiments, organizing the work and analyzing experimental data. Upon successful completion of the research project, students are able to scientifically analyze, interpret, discuss and present their obtained results in the context of current literature.

Teaching and Learning Methods:
Depending on the individual project, the students will gain and practice laboratory skills and/or knowledge on handling of plants in greenhouse/field experiments through hands-on lab practicals and/or hands-on phenotyping methods. Through instruction by their advisor, they will learn to define specific scientific questions related to their individual topic, to find solutions to solve these questions and to discuss the results. By preparing an oral presentation and a final written report, students learn how to adequately describe their experiments, how to structure the results and how to discuss the results in view of current literature.

Media:
Experimental studies related to current research projects, current literature

Reading List:
Project-specific current literature will be provided for each project.
General:
- Grotewold, Chappell and Kellogg: Plant Genes, Genomes and Genetics. Wiley-Blackwell, 2015. ISBN: 978-1-119-99887-7
- Brown: Genomes 4. Garland Science, 2017. ISBN 978-0-815-345084
- Abraham Blum: Plant Breeding for Water-limited Environments, Springer Science + Business Media S.A.; ISBN-10:1441974903

Responsible for Module:
Schön, Chris-Carolin; Prof. Dr.sc.agr. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Forschungspraktikum Molekulare Pflanzenzüchtung (Forschungspraktikum, 10 SWS)
Avramova V, Eggels S, Mohler V, Polzer C, Urzinger S
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1592: Research Project 'Physiological Pomology' | Research Project 'Physiological Pomology'

Version of module description: Gültig ab summerterm 2015

Module Level: Master	**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:
Two presentations (15 min each) will be given by the participants on the experiment planning and on the results of an experiment; a final colloquium (15 min) will be held. In these parts of the examination the participants will demonstrate their knowledge on special aspects of physiological pomology and will show theri competence in a project's organization. The students will furthermore show that they are able to present their knowledge well structured and that they are able to transfer their knowledge on solving other experimental problems. For individual preparation of the colloquium the students have to prepare a protocol about their experiment. This serves as a control of their ability for describing, evaluating and interpreting experimental results. The final grade will be equally calculated from the presentations and the colloquium.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Basics in fruit science and plant physiology

Content:
Students have to work on questions related to pomology in its broadest sense. Possible topics for practical work may concern tree fruit physiology, in vitro propagation, resistence to pathogens and environmental stress, effects of growth regulators on the physiology of tree fruits. Depending on the special topic the techiques which are to be practiced can be the following: molecular detection of plant enzymes or pathogens (e.g. viruses, phytoplasms), chromatographic analyses of plant metabolites, histology and microscopy. The plant material used will be cultured either in vitro or in the greenhouse or the in orchard. According to the individual experiments evaluation of plant growth, of fruit yield and quality, of plant viality or susceptibility to pathogens will be included. The topics will be offered on request.

Intended Learning Outcomes:
After the course the participants will have advanced knowledge in planing, preparing and performing experiments on tree fruits with respect to physiology. They are able to organize a physiological project independently on the basis of literature. After the experiment they are able to critically evaluate the data in comparison with the relevant scientific literature.

Teaching and Learning Methods:
Teaching methods: advicing conversations, demonstration, practical experiments, discussion of results. Learning activities: reading of script and literature, training of laboratory techniques, writing and pressenting protocolls

Media:
presentations using powerpoint, scriptum (as download), practicval laboratory training

Reading List:
project related scientific literature, scientific journals according to recommendation of the supervisor

Responsible for Module:
Dieter Treutter (dieter.treutter@mytum.de)

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

Dieter Treutter (dieter.treutter@mytum.de) Susanne Rühmann (susanne.ruehmann@wzw.tum.de)
Johannes Hadersdorfer (<johannes.hadersdorfer@wzw.tum.de)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1576: Research Project 'Plant Growth Regulation' | Research Project 'Plant Growth Regulation'

Version of module description: Gültig ab winterterm 2019/20

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 10	**Total Hours:** 300	**Self-study Hours:** 150	**Contact Hours:** 150

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

Description of Examination Method:
The students conduct a six-week research project in the lab. The work-schedule can be adjusted to the curriculum of the students. After the practical work, a report (approximately 15 to 20 pages) has to be prepared and handed in usually within 4 weeks after the laboratory work has been concluded. By preparing a report the students demonstrate the ability to summarise the theoretical background and key aims of the performed experiments and to present the acquired results in a concise and coherent manner and to interpret and discuss the experimental data in the context of available literature. The grade of the report is based on the accuracy and correctness of the results (50%) and the quality of presentation and evaluation of the data (50%), particularly the description of the theoretical background, presentation of raw data, calculations, application of statistical tests and interpretation and discussion of the results.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge in plant molecular biology, biochemistry, genetics and development. Practical experience with basic lab working techniques such as pipetting and working under sterile conditions. Successful completion of the lecture(s) Crop Biotechnology and/or Plant Biotechnology.

Content:
As primary resource of biomass, plants grow by continuous formation of modular organs. The net growth is the result of different growth parameters including the rate of organ formation, the size of the single organs and the overall amount of formed organs. Moreover, it is strongly dependent on environmental conditions (nutrients, water, light and temperature) and the germplasm (constitution of limiting genetic factors and overall genome structure). Plant growth optimization is thus a multifactorial process and strongly dependent on the specific utilization of the crop.

The present research project deals with the molecular characterization of genetic factors which act limiting on the different growth parameters mentioned above. Known and novel important yield affecting loci are identified and positioned in the established regulatory network. Methods and techniques applied in the framework of the course will depend on the individual project and may include: Quantitative analysis of shoot growth (leaf formation rate, determination of meristem size), quantitative analysis of shoot regeneration in tissue culture, gene expression analysis (GUS reporter/qPCR/Western blotting), cloning of T-DNA constructs, plant transformation, PCR genotyping, protein expression and purification, fluorescence and electron microscopy.

Intended Learning Outcomes:
Upon completion of this module students are able:
- to understand key scientific aims in the field of Plant Growth Regulation;
- to assess methods to identify relevant molecular factors controlling plant growth;
- to experimentally characterize regulatory pathways affecting leaf formation rate, elongation growth and shoot architecture;
- to interpret results from biochemical, genetic and physiological experiments dealing with Plant Growth Regulation.
- to present the obtained data in a written report and to discuss the results in the context of relevant literature.

Teaching and Learning Methods:
Close theoretical and practical supervision combined with autonomous lab work enables the student to understand and apply basic experiments in Plant Growth Regulation. By discussing lab protocols the student analyses the underlying methodological principles of the experiments. By reading original research articles the student learns to assess quality standards for experiments analyzing plant growth parameters. By writing a research report the student learns to summarize the obtained results and discusses it in the context of relevant literature.

Media:
Oral instructions, lab protocols, relevant scientific publications.

Reading List:
Plant Physiology and Development (2014) L. Taiz and E. Zeiger, Sinauer Associates Inc.,U.S.;
Plant Biotechnology and Agriculture: Prospects for the 21st Century (2011) A. Altman and P. M. Hasegawa, Academic Press.

Responsible for Module:
Sieberer, Tobias; Dr. nat. techn.

Courses (Type of course, Weekly hours per semester), Instructor:
Forschungspraktikum Wachstumsregulation der Pflanzen (Forschungspraktikum, 10 SWS)
Poppenberger-Sieberer B, Sieberer T, Dündar G
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1549: Research Project 'Plant Nutrition' | Research Project 'Plant Nutrition'

Version of module description: Gültig ab winterterm 2021/22

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 10	**Total Hours:** 300	**Self-study Hours:** 150	**Contact Hours:** 150

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

Description of Examination Method:
The examination of the module is done in the form of a research paper and includes a written lab / project report of about 3000 words / 20 pages and a presentation (30 min).
The final grade is an averaged grade from the written lab report (75 %) and from the presentation (25 %).

The learning outcome is tested by a graded project report (75%). Students show that they are able to introduce (state-of-the-art, hypothesis, research question), record, structure, analyze, evaluate, and summarize their research work and that they can conclude on the achieved results from the experiments and analyses. In the report they show that they can relate background knowledge, e.g. reactions of plants to abiotic stress, to the own performed research in the lab. They show how the specific methods are applied, critically evaluate the suitability of the methods, present results in a structured way in relation to the research question, discuss their results with respect to the present state-of-the art knowledge and formulate perspectives.
The students demonstrate with the report to have gained deeper knowledge on employed methods and on the investigated research topic.
The project report will be complemented by a graded oral presentation (25%) in which students show their communication competency in presenting their scientific work and project to a scientific audience. The students are expected to present (about 20 min) and discuss (about 10 min) their research results according to scientific standards.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Basic knowledge in (molecular) plant nutrition and plant physiology

Content:
Current research topics in molecular plant nutrition e.g., plant responses to abiotic stress (nutrient deficiency, nutrient toxicity, drought, salinity, heat, changing wheather extremes), nutrient efficiency mechanisms, nutrient transport in the plant and in the substrate/soil, and nutrient turnover and losses to the environment.
Studies focus on specific experimental and methodological skills employed in current plant nutritional approaches in order to investigate and understand yield formation, root system architecture development, nutrient acquisition and nutrient translocation at the cellular and the whole plant level, as well as the nutrient- and/or water status of plants.

Intended Learning Outcomes:
At the end of the module students will be able to:

- apply theoretical background knowledge on the selected research area in plant nutrition (e.g. molecular, biochemical, morphological or physiological causes and consequences of abiotic stress such as nutrient deficiency or nutrient toxicity to plants, challenges in nutrient efficiency and in nutrient losses to the environment);
- judge on plant cultivation growth set-ups suitable to phenotype and evaluate root- and shoot growth and development under nutrient limiting conditions;
- operate up-to-date and modern techniques ranging from molecular biological to classical plant nutritional techniques (methodological competencies) to understand the nutritional status of (crop) plants as well as their response reactions to deficient or toxic nutrient levels;
- assess open questions related to crop growth and health using molecular, physiological, and analytical methods;
- execute specific and appropriate methods for data acquisition in the selected research area (e.g., molecular biological and chemical analyses, non-destructive or minimal-invasive imaging techniques);
- apply specific techniques of data analysis (e.g., specific statistical evaluation methods, phenotyping and architecture analysis software);
- develop critical thinking ability for experimental approaches understanding current challenges in plant nutrition;
- evaluate the achieved results with respect to suitability of different current and developing analytical research methods;
- structure achieved knowledge and results for a written report and an oral presentation;
- present their work to an audience and defend their results in a scientific discussion after the oral discussion;

Teaching and Learning Methods:
In the laboratory course students will be supervised and trained individually or in small groups to practically use specific methods of plant nutrition (by e.g. molecular, chemical, biochemical, physiological analyses, imaging techniques, plant growth cultivation techniques, statistical evaluation methods, etc.). Thereby, they will achieve basic hands-on experiences in molecular plant nutritional and crop physiological skills to solve subsequently own-defined open questions

in plant nutrition. Students will get the chance to self-dependently test current and developing methods so that they become able to evaluate their suitability.
The module also includes the individual search on current literature, a training in the generation of a research report and a training in presentation techniques.

Media:
Presentations (e.g., PowerPoint), scripts, instruction manuals, whiteboard work, data analysis software (e.g., EXCEL), Zoom, lab-book, TUM-Moodle

Reading List:
-Marschner, H., 1995: Mineral Nutrition of Higher Plants, Academic Press London, 2nd Edition.
-Marschner, P. (ed) 2012: Marschner's Mineral of Higher Plants, Academic Press London, 3rd Edition
-Journal articles
-Topical and up-to-date Journal reviews (provided by the supervisor)

Responsible for Module:
Bienert, Gerd Patrick, Prof. Dr. patrick.bienert@tum.de

Courses (Type of course, Weekly hours per semester), Instructor:
Research Project Plant Nutrition (Praktikum, 10 SWS)
Bienert G, von Tucher S, Liu Z, Alcock T
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1586: Research Project 'Plant Pathology' | Research Project 'Plant Pathology'

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 10	**Total Hours:** 300	**Self-study Hours:** 100	**Contact Hours:** 200

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

Description of Examination Method:
Logging and presenting of own research results

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge in plant science

Content:
Insights into the problem-oriented work with modern methods of biological sciences. Obtaining a profound understanding and ability to apply research methods in Agrobio sciences. Insights into the scientific approach to issues from relevant research projects. Learning the presentation of research results.

Intended Learning Outcomes:
Learning of techniques for independent scientific analysis of research subjects in plant sciences. Participation in a current research project.

Teaching and Learning Methods:
laboratory work, presentation

Media:

Reading List:

Responsible for Module:
Ralph Hückelhoven hueckelhoven@wzw.tum.de

Courses (Type of course, Weekly hours per semester), Instructor:
Forschungspraktikum Agrobiowissenschaften Pflanze/Phytopathologie (Forschungspraktikum, 10 SWS)
Hückelhoven R, Hausladen J, Engelhardt S, Ranf-Zipproth S, Schempp H, Stam R, Stegmann M
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1587: Research Project 'Secondary Plant Metabolites' | Research Project 'Secondary Plant Metabolites'

Version of module description: Gültig ab summerterm 2015

Module Level: Master	**Language:** German/English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 5	**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:
Two presentations (15 min each) will be given by the participants on the experiment planning and on the results of a laboratory experiment; a final colloquium (15 min) will be held. In these parts of the examination the participants will demonstrate their knowledge on secondary metabolites and their analytics and will show theri competence in a project's organization. The students will furthermore show that they are able to present their knowledge well structured and that they are able to transfer their knowledge on solving other experimental problems. For individual preparation of the colloquium the students have to prepare a protocol about their experiment. This serves as a control of their ability for describing, evaluating and interpreting experimental results. The final grade will be equally calculated from the presentations and the colloquium.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Basics in organic chemistry and biochemistry, knowledge on bioactive compounds

Content:
Students have to work on an analytical project on secondary metabolites or on managing the bisoynthesis of secondary metabolites in plants for improving quality or resistance. A further possible experimental field is the profiling of bioactive compounds in plant foods. Depending on the research project the following methods will be used: chromatography, spectroscopy, enzymatic assays, transcriptome analyses.

Intended Learning Outcomes:
After the course the participants have advanced knowledge in analysis of secondary metabolites in plants including the characterizaton of the molecule structure and the metabolite quantification.

The participants have advanced knwoledge on biosynthesis of secondary metabolites and on its elicitation and where applicable on pathogen action. They are furthermore able to organize a chemical analysis project independently on the basis of literature. After the experiment they are able to critically evaluate the data in comparison with the relevant scientific literature.

Teaching and Learning Methods:
Individual advice and demonstrations by the supervisor, practical laboratory training, discussion of results and problems with the supervisor; literature study as recommended by the supervisor; writing a protocoll on experiment planning and results

Media:
presentations with powerpoint, scriptum, laboratory training with personal advice by the supervisor, practical work on a project

Reading List:
actual scientific literature provided by the supervisor

Responsible for Module:
Dieter Treutter (dieter.treutter@mytum.de)

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

Dieter Treutter (dieter.treutter@mytum.de) Susanne Rühmann (susanne.ruehmann@wzw.tum.de)
Ionela Regos
Johannes Hadersdorfer
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1662: Research Project 'Woody Plant Pathology' | Research Project 'Woody Plant Pathology'

Version of module description: Gültig ab summerterm 2016

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 10	**Total Hours:** 300	**Self-study Hours:** 150	**Contact Hours:** 150

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

Description of Examination Method:
In the oral presentation students are expected to present and discuss their research results according to the scientific practice.
They will be asked to discuss and critically evaluate the achieved results with respect to the applied methods and compared to current literature.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowlegde in plant pathology (of temperate fruit crops)

Content:
Current research topics in plant pathology of temperate fruit crops (detection, transmission, maintenance for further research, ...).
Studies focus on specific experimental and methodological skills in plant pathology for reliable inoculations, detection of phytopathogens and analysis of host-pathogen-interaction. These methods include PCR, qPCR, LAMP, ELISA, tissue culture, cultivation in greenhouse and inoculation trials.

Intended Learning Outcomes:
At the end of the modul students will be able to
- to apply the theoretical background knowledge on the selected research area (e.g. diseases and their causal agents of temperate fruit crops)
- to utilize specific and appropriate methods for data collection and evaluation of the achieved results
- to apply specific techiques of data analysis

Teaching and Learning Methods:
Practicals, projects

Media:
presentations, prescripts, instruction manuals

Reading List:
Original papers

Responsible for Module:
Johannes Hadersdorfer johannes.hadersdorfer@mytum.de

Courses (Type of course, Weekly hours per semester), Instructor:
Research Project - Woody Plant Pathology
Übung
10 SWS

Johannes Hadersdorfer
Professur für Obstbau TUM
johannes.hadersdorfer@mytum.de

Johannes Hertrich
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gu27cit@mytum.de

Johanna Stammler
Professur für Obstbau TUM
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For further information in this module, please click campus.tum.de or here.

Module Description

WZ1921: Strategy, Supply Chain Management, and Sustainability in Agribusiness and the Food Industry | Strategy, Supply Chain Management, and Sustainability in Agribusiness and the Food Industry

Version of module description: Gültig ab winterterm 2017/18

Module Level: Master	**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:
The course grade is based on the learning portfolio. The portfolio submitted includes memorandums addressing 9-10 of the case studies discussed in class; and a learning statement addressing conceptual, scientific and personal learning. Through the case memorandums the students show the ability to discuss the assigned case questions by selecting and applying suitable theoretical concepts to supply chain management and sustainabiltiy challenges in the specific context of agricultural, food, and related industries. In the learning statement students demonstrate the ability to reflect on the semester long learning process and summarize the insights gained.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Solid economic and management background; knowledge of basic concepts of strategic analysis, planning, and management (e.g., industry analysis, horizontal and vertical coordination, and SWOT), as well as the ability to apply these concepts; and knowledge of value chain management is required (e.g., theoretical background, supply chain dynamics, actors and partnerships, governance). Successful completion of a management course on M.Sc. level required, e.g., agribusiness management, organizational behavior, or value chain management. Medium level experience in desk research and scientific writing is required.

Content:
Key concepts of supply chain management, strategy, and sustainability: processes of supply chain management (e.g., creating added value, management of customers and suppliers);
Innovation, sustainability as innovation;

sustainable supply chains; CSR and sustainability measurement; implemention of a sustainability strategy, costs and benefits of sustainable practices in the context of agricultural, food and related industries;
ethical issues in supply chain management.

Intended Learning Outcomes:
Upon completion of the module students are able to evaluate processes of agricultural supply chains management, e.g., creating and capturing value, management of customers, suppliers, and other stakeholders;
for the areas strategy, supply chain management, and sustainability students can independently choose scientific models or concepts relevant to the analysis process and justify their evaluation;
students are able to evaluate the implementation a CSR concept or sustainability strategy, and to monitor its effects on operations, suppliers, associates, and customers;
Students are able identify and analyze ethical issues in supply chain management and to recommend how to apply ethical practices.

Teaching and Learning Methods:
Seminar: Case study based class discussions and presentations, group work based on cases, students' experiences and assignments. Through individually prepared class discussions and group work, students develop the ability to critically reflect and apply concepts of strategy, supply and value chain management in the context of sustainability.

Media:
Reading assignments; case descriptions, presentations, and discussions, supported by Metaplan, flipchart and other facilitation media.

Reading List:
Current articles from scientific journals as appropriate.
Selected chapters from
Bouchery, Corbett, Fransoo, and Tan (2017): Sustainable Supply Chains: A Research-Based Textbook on Operations and Strategy. Springer: Berlin, Heidelberg, Germany.
Pullmann and Wu (2011): Food Supply Chain Management: Economic, Social and Environmental Perspectives. Routledge, New York, US.

Responsible for Module:
Bitsch, Vera; Prof. Dr. Dr. h.c.

Courses (Type of course, Weekly hours per semester), Instructor:
Strategy, Supply Chain Management, and Sustainability in Agribusiness and the Food Industry (Seminar, 4 SWS)
Bitsch V [L], Bitsch V, Carlson L, Huhn C, Wagner C
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1567: Sustainability: Paradigms, Indicators, and Measurement Systems | Sustainability: Paradigms, Indicators, and Measurement Systems

Version of module description: Gültig ab summerterm 2019

Module Level: Master	Language: 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 assessment type for the module is a graded report (10 pages). The report includes three sections: (1) critical analysis of a published empirical sustainability study in the context of its sustainability definitions and authors' backgrounds; (2) critical analysis of a sustainability measurement system in use with regard to fulfilling requirements to be met by indicators and indicator systems; (3) critical analysis of a public sustainability claim by an organization from a consumer or citizen point of view. Each analysis is also presented by each student. Through reports, the students demonstrate the ability to understand relevant research, measurement systems and claims, as well as critically analyze and discuss these issues. Through the presentation and discussion of each analysis, students demonstrate their ability to communicate these critical issues and further reflect on each topic in the light of other students' questions and presentations.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge and understanding of economic and management concepts as well as of social science research methods is required.

Content:
The development of a differentiated understanding of sustainability requires the critical analysis and reflection of sustainability concepts on multiple levels. In the module the following levels are systematically analyzed and discussed based on guided discussions of assigned readings and materials developed by students based on literature and internet research:
- Paradigms and value judgments in research on and evaluation of sustainability;

- Economic, environmental and social aspects of sustainable production, marketing, and consumption;
- Measurement systems for sustainability on different levels (products, supply chains etc.);
- Public and private standards, sustainability certifications and communication;
- Consequences of measurement systems and their foci, e.g., on environmental aspects, such as carbon footprint, or on social aspects, such as fair trade

These topics are discussed in the context to current and controversial issues regarding sustainability in science and in society.

Intended Learning Outcomes:

After successfully completing the module students are able to

- Analyze and evaluate the consequences of different paradigms on the definition and understanding of sustainability and its use in published scientific articles;
- Analyze and evaluate sustainability measurement systems on the product, enterprise, and supply chain levels as well as their potential consequences;
- Evaluate public sustainability claims based on the research of available information sources;
- Apply a differentiated understanding of sustainability in an interrelated, globalized context with differing value systems and priorities in scientific and practical questions and issues.

Teaching and Learning Methods:

The course “Sustainability: Paradigms, Indicators, and Measurement Systems” has a seminar format based on assigned readings and student presentations on assigned topic areas.
After an introductory guided class discussion on assumptions and implicit sustainability definitions of participants, readings are assigned and discussed in class to lay the basis for later student presentations. Through individual document research and individually prepared class presentations, students develop the ability to critically reflect on sustainability research, sustainability indicators and measurement systems, as well as sustainability claims by various actors and organizations. Through presentations and concept discussions, students develop in-depth knowledge of sustainability issues and hone their critical thinking skills. A final discussion summaries students’ learning and additional findings throughout the semester in the concept of wicked problems.

Media:

Reading assignments; use of data bases for literature research; presentation software; discussion facilitation support media, such as flipcharts and discussion boards; video clips and podcasts.

Reading List:

National Resource Council 2010, Toward Sustainable Agricultural Systems in the 21st Century, Washington/D.C.: National Academies Press.
Current articles on sustainability paradigms, requirements of sustainability indicators and indicator systems, and applications.

Responsible for Module:

Courses (Type of course, Weekly hours per semester), Instructor:
Sustainability: Paradigms, Indicators, and Measurement Systems (Seminar, 4 SWS)
Bitsch V [L], Bitsch V, Carlson L
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1676: Sustainable Land Use and Nutrition | Sustainable Land Use and Nutrition

Version of module description: Gültig ab summerterm 2022

Module Level: Bachelor	**Language:** 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:
During the participation in the lecture (usually Friday + Saturday), students give talks on given topics (10 min per student plus 5 min discussion und questions per student). Here, the students demonstrate that they have gained deeper knowledge of a given topic by using literature and are able to present their knowledge and discuss it. In the written examination (90 min) at the end of the semester students demonstrate the theoretical knowledge of the various perspectives of sustainable land use and nutrition by answering questions under time pressure and without helping material.
The final grade is a combined grade from the written examination (50 %) and from the student's talk (50 %).

Repeat Examination:
End of Semester

(Recommended) Prerequisites:

Content:
The module provides an overview on the various perspectives of sustainable land use and nutrition. An introduction establishes the structure of the module, which follows a supply chain:
1) The production of commodities addresses: Availability of soil resources; ecology and history of landscapes; terrestrial ecology; horticultural products for sustainable nutrition; integrative land-use concepts; production technology. 2) The distribution of commodities (transport, storage) is analyzed under the aspects of resource economics. 3) Sustainability of processing. 4) The distribution through trade and services is focused by sustainable marketing concepts. 5) Finally, consumer affairs are addressed by health aspects in the context of global nutrition; food safety; new designed food.

Intended Learning Outcomes:
The students know about the great variety of sustainability aspects in land use and nutrition. They understand the preconditions to understand the complexity and interconnectedness of multiple sectors. Students are able to analyze sustainability concepts and to transfer them to new problems. They understand that only a comprehensive perspective will lead to sustainable concepts for land use and nutrition.

Teaching and Learning Methods:
Lecture, discussion, students’ talks

Media:
PowerPoint, research literature on moodle, Handouts

Reading List:
Each lecturer provides a list of articles regarding his/her topic on moodle and also during the lecture itself.

Responsible for Module:
Knoke, Thomas; Prof. Dr. rer. silv.

Courses (Type of course, Weekly hours per semester), Instructor:
Sustainable Land Use and Nutrition (Vorlesung, 4 SWS)
Windisch W [L], Abate Kassa G, Albrecht H, Bernhardt H, Bucka F, Eisner P, Hauner J, Knoke T, Langowski H, Leonhardt S, Roosen J, Schad P, Stark T, Windisch W
For further information in this module, please click campus.tum.de or here.

Module Description

WZ2763: Transcriptional and Posttranscriptional Regulation in Eukaryotes | Transcriptional and Posttranscriptional Regulation in Eukaryotes

Version of module description: Gültig ab winterterm 2019/20

Module Level: Master	**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 written examination (60 min, Klausur) students demonstrate by answering questions under time pressure and without helping material the theoretical knowledge of components, processes and mechanisms of transcriptional and posttranscriptional regulation in eukaryotes and of methods to study them.
By comparing different techniques applied to the study of transcriptional regulation student demonstrate that they can evaluate their advantages and disadvantages for answering a given experimental question.
Their ability to analyse and evaluate a research paper and to structure the content such that they can clearly explain it to an audience, is examined during their presentation of a research paper assigned to them in a PowerPoint presentation. To demonstrate that they have acquired the ability to discuss scientific data the students generate questions about the paper to guide a discussion after their presentation.
The goals of the module have been reached and the module has been passed when the total grade of written exam and presentation (3:2) is better than 4.1.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Fundamental knowledge in genetics and molecular biology is highly recommended. The participants should have passed one or more bachelor level lectures in genetics, genomics, systems biology, developmental genetics of plants and/or developmental genetics of animals.

Content:
The development of an organism and its developmental and physiological responses to the environment are based on a precise spatio-temporal regulation of genes. The lecture and associated seminar will cover mechanisms of gene regulation. They are suitable for MSc students as well as highly motivated and advanced BSc students.

The lecture (90 mins per week) will cover:
- Transcriptional machinery
- Structure of eukaryotic chromatin
- Epigenetic modifications and chromatin remodelling
- Gene activation and repression
- Transcription factors
- Combinatorial transcription factor complexes in signal integration
- Regulation of transcription factors by posttranslational modification
- Transcription factor evolution and its role in acquisition of novel traits
- RNA molecules and RNA processing
- Regulatory RNAs
- Methods to study transcriptional regulation

The accompanying seminar (90 min per week), will include discussions on a range of original landmark papers covering different aspects of transcriptional regulation comprised in the lecture (most examples will be from plants). Furthermore, students will get advice on how to give a good presentation and will get feedback on the quality of their own presentation and advice for possible improvement.

Intended Learning Outcomes:
At the end of the module students have a profound understanding of the role and of different mechanisms of transcriptional and posttranscriptional regulation in eukaryotes. They know different techniques of how to study eukaryotic chromatin, transcription factor-DNA interactions (such as promoter deletion series for identification of cis-elements, ChIP, DIP, EMSA, microscale thermophoresis), their advantages and disadvantages. Thus, they are able to determine the correct experimental approach to address research questions in transcriptional and posttranscriptional regulation. Additionally, they are able to critically evaluate unfamiliar results in original papers related to transcriptional and posttranscriptional regulation. In the seminar, they have acquired practice in presenting original research data and gained the ability to discuss such data with their colleagues.

Teaching and Learning Methods:
LECTURE: Presentation with PowerPoint and black board. The presentation will be interrupted with questions to the students to keep their active attention and to induce reflection on the content of the lecture (Sokrates' midwife method). Short breaks will give the possibility to students to ask questions during the lecture.
SEMINAR: Students will use PowerPoint to present a research paper, which has been assigned to them. The instructor will help in guiding the discussions and will contribute questions to make

students aware of details and induce their reflection of the content. They acquire practice in presenting original research data and gained the ability to discuss such data with their colleagues.

Media:
LECTURE: Power point, black board, discussion. PDFs of the lectures will be made available to the students.
SEMINAR: Powerpoint, black board, discussion.

Reading List:
LECTURE:
Benjamin Pierce, Genetics: a conceptual approach, 2013 5th edition (or newer)
James Watson, Molecular Biology of the Gene, 2014 7th edition (or newer)
Michael Carey et al. Transcriptional regulation in Eukaryotes, 2009, 2nd edition (or newer)
Original articles used to increase the content of the lecture will be cited on the power point slides.
SEMINAR:
Original articles will be distributed to the individual speakers in the first seminar session.

Responsible for Module:
Gutjahr, Caroline; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Transcriptional and Posttranscriptional Regulation in Eukaryotes with Special Emphasis on Plants (Seminar, 2 SWS)
Gutjahr C

Transcriptional and posttranscriptional regulation in eukaryotes (Vorlesung, 2 SWS)
Gutjahr C, Torres Ruiz R
For further information in this module, please click campus.tum.de or here.

Module Description

WZ1591: Winterschool Horticultural Science | Winterschool Horticultural Science

Version of module description: Gültig ab winterterm 2013/14

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 50	**Contact Hours:** 40

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

Description of Examination Method:
Written protocol. And this written protocol (3-5 pages) the students should highlight the presented actual scientifc topics in horticulture and reflect them of relevance to practical sustainable horticulture.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge in plant production

Content:
Selected scientific topics on horticultural research will be addressed and presented by teachers from various partner universities. Actual research activities and a survey of basic research related to horticulture are highlighted by the scientists teaching in the master course. Examples of subjects are: the role of horticulture in the society: technical, organisational and productive aspects; from ecology to engineering: plant response based process control in greenhouses; growth regulation by plant hormones - biology and application; net ecosystem carbon and greenhouse gas budget in orchards; sustainability in horticultural value chains: challenges and perspectives; chemical ecology in sustainable agriculture: from research to application.

Intended Learning Outcomes:
At the end of the module students are able understand the scientific contribution of basic and applied research of various institutes to horticulture. The know the interplay of the different scientific disciplines in teaching and research. The students will show this by a written protocol highlighting actual scientifc topics in horticulture including a reflection of relevance to practical sustainable horticulture

Teaching and Learning Methods:
Lectures, seminars, excursions, workshops

Media:
Presentations, scriptum

Reading List:
Scriptum

Responsible for Module:
Dieter Treutter dieter.treutter@mytum.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Winterschool Horticultural Science
2 SWS
Dieter Treutter
dieter.treutter@mytum.de

N.N. (Different Lecturers of the Partneruniversities)
For further information in this module, please click campus.tum.de or here.

Other Universities | Other Universities

University of Bologna | University of Bologna

Module Description

WZ9301UB: Advanced Entomology | Advanced Entomology

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 2	**Total Hours:** 60	**Self-study Hours:** 36	**Contact Hours:** 24

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

Description of Examination Method:
There will be one final mark. Coursework will be weighted as follows: final written exam (80%), student reports (20%). it will not be possible to pass the course if the final written exam has a mark lower than 18/30. Criteria for the evaluation of the written exam: correctness of answers; ability to summarize, evaluate, and establish relationships between topics of relevance; develop critical and independent thinking. No learning aids will be allowed during the examination. Maximum duration of the exam: 120 minutes.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Students should be familiar with basic concepts of biology, zoology, general entomology and ecology of agricultural systems.

Content:
The module consists of 12 h of frontal lectures and 8 h of practical part. The frontal lectures start with an overview of fundamentals in entomology. Students are then introduced to pest control management and insect ecology, key pests of apple, grape and other fruit crops. Emphasis is placed on herbivores, predators and parasitoids occurring in each agro-ecosystems. Methods of pest control, in particular biological control, are outlined and discussed. The practical part provides particular instruction on main key pest insects occurrig in apple and grape crops and on the new control strategies currently under development.

Intended Learning Outcomes:
By the end of the module, graduate students should acquire knowledge on pest insects and pest management strategies, emphasizing ecological principles and their applications within the major agro-ecosystems of fruit trees cultivation. The biology and management of key pests in the main fruit production systems in Alpine regions will be considered, as apple, grape, cherry, plum, peach, strawberry and other small/soft fruits. Specific attention will be given to biological control and IPM strategies, understand of the pest complexes of the agro-ecosystems, chemical ecology, tritrophic interaction, natural enemies, and monitoring programs.

Teaching and Learning Methods:
This module is a traditional lecture/lab based course in which topics are presented by the Professor. Practical parts, lab activities, and excursions are explained by the Professor . Generally Power Point presentations will be available in the course reserve collection database of the Faculty 1 day after each single lecture. Additional material will be provided by the Professor.

Media:
Presentation slides, websites, articles and short texts, student presentations

Reading List:
Aluja M., Leskey T.C., Vincent C. (Eds.) 2009: Biorational Tree-Fruit Pest Management, CABI Publishing, Wallingford, UK, 295 pp. ISBN: 1845934849.
Heikki M.; Hokkanen T., Lynch J.M. (Eds.) 1996: Biological Control - Benefits and Risks, Cambridge University Press, UK, 326 pp. ISBN: 9789048126651.
Koul O., Cuperus G.W., Rolff J. (Eds.) 2007: Ecologically Based Integrated Pest Management, CABI Publishing, Wallingford, UK, 462 pp. ISBN: 9781845930646.
Lichtfouse E., Navarrete M., Debaeke P., Véronique S., Alberola C. (Eds.) 2007: Sustainable Agriculture, Springer, the Netherlands, 919 pp. ISBN: 9789048126651.
Pedigo L.P., Rice M.E. 2009: Entomology and pest management, 6th Ed. Pearson Prentice Hall Upper Saddle River (NJ), 784 pp. ISBN: 0135132959.
Peshin R., Dhawan A.K. (Eds.) 2009: Integrated Pest Management, Volume 2: Dissemination and Impact, Springer, New York (NY), 634 pp. ISBN: 1402089899.
Schowalter T.D. 2011: Insect Ecology: An Ecosystem Approach, 3rd Ed. Academic, San Diego (CA), 633 pp. ISBN: 0123813514.

Responsible for Module:
Sergio Angeli Sergio.Angeli@unibz.it

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung und Laborpraktikum
Advanced Entomology
2 SWS
Sergio Angeli
UniBz

Sergio.Angeli@unibz.it
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9303UB: Advanced Plant Protection | Advanced Plant Protection

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 2	**Total Hours:** 90	**Self-study Hours:** 45	**Contact Hours:** 45

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

Description of Examination Method:
The examination consists of a presentation of a plant pathology topic in a 30 minutes oral report, including subsequent discussion. The presentation is a mean to estimate the student’s ability to understand plant pathology, to summarize the topic and present it to an audience, and to conduct a discussion about the presented subject.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Basic knowledge in plant biology, plant pathology

Content:
Principles of managing insects, diseases or weeds will be discussed in the context of developing stable agricultural systems. Introduction to the management of pests, in agricultural systems, providing the basis of understanding, the interpretation, selection, development and application of the most effective methods of Integrated Crop Management, with the least disruption to the environment. A more detailed understanding of the effects of pest pressure on crop productivity and the development of threshold levels for action will be developed. Discussion of the new scenario of crop protection created by the policy on the use of pesticides started 20 years ago by the European Union to reduce their impact on health and environment. It is a topic that should be known since the new legislation for crop protection is becoming a very complex practice, because it is based on technical means more and more difficult to use also for legislative limitation. The EU policy is changing the regulatory framework for the homologation and use of products for plant protection in member states and this will have an impact in the different European countries.

Intended Learning Outcomes:
Upon completion of the course students will be able to recognize the main diseases of fruit trees, to analyze the interactions among plants, pathogens and environment, as factors determining the development, spread and severity of the disease.
The students will be able to discuss on the methods used for disease control (biological, chemical, resistance induction). In particular, the students will develop the knowledge required by following the lectures of the course, reading scientific papers, internet, to solve and discuss report cases. Students should be able to write disease plant protection reports pertinent to the intended audience.
Students will be able to describe in oral form their experiences in controlling an unknown plant disease. The students are able to evaluate and manage the soil fertility to increase crop production and quality and, at the same time, minimize the environmental impact.

Teaching and Learning Methods:
Lecture, presentation of the lecture contends on slides using PowerPoint

Media:
Presentation, slides of plant diseases, articles

Reading List:
Handouts and selected paper will be given to the students during the lecture by the instructor.

Responsible for Module:
Annamaria Pisi annamaria.pisi@unibo.it

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung
Advanced Plant Protection
3 SWS
Annamaria Pisi
UNIBO
annamaria.pisi@unibo.it
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9308UB: Advanced Techniques Applied to Grape | Advanced Techniques Applied to Grape

Version of module description: Gültig ab winterterm 2012/13

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

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

Description of Examination Method:
Written/oral exam

Repeat Examination:

(Recommended) Prerequisites:
B.Sc.

Content:
Characterization of grape cultivars. Peculiar aspects of breeding in viticulture. Effects of genetic and climatic aspects and of vineyard management techniques (training systems, winter and summer pruning, canopy management, soil management, nutrition and irrigation, mechanization) on yield and ripening process.

Intended Learning Outcomes:
Providing basic knowledge on international cultivars characterization. Deepening grape berry maturation physiology aspects as base of choose of vineyard management systems in relation to soil and climatic conditions and to oenological objectives.

Teaching and Learning Methods:
Lectures, seminars, field training

Media:

Reading List:
Winkler et al. 1975: General viticulture. University of California Press.
Scientific papers distributed by the teacher.

Responsible for Module:
Ilaria Filipetti

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

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

Module Description

WZ9306UB: Agricultural Policies Evaluation | Agricultural Policies Evaluation

Version of module description: Gültig ab summerterm 2013

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

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

Description of Examination Method:
"For attending students the final grade for the module will be calculated thusly:
- in class grade: policy brief, case analysis, articles revision and discussion, and other class activities (50% approximately)
- policy paper preparation and discussion (50% approximately)

For non-attending students the final grade will be calculated thusly:
- policy paper* preparation and discussion (50% approximately)
- oral (50% approximately)

Students will be required to produce a policy paper of max 3500 words. Attending students will present the paper during the class and discuss with the lecturer. Non attending students will present and discuss the paper with the lecturer."

Repeat Examination:

(Recommended) Prerequisites:
Students should have some background knowledge in economics.

Content:
Unit 1 - Public policy formulation and design
What is public policy. Policy analyst: role, ethic and values. The policy process: problem identification, agenda setting, policy development, policy implementation. Institutional and non-institutional actors. Policy briefs: what are policy briefs?; policy briefs typologies (advocacy and objective); how to design and develop a policy brief.

Unit 2 - Agricultural and food policy: definition, objectives, stakeholders, tools

Agriculture and economic development; Sustainable development; Agriculture and international relations; Agricultural and food policy: definition, objectives, stakeholders, tools.

Unit 3 - The Common Agricultural Policy: history, development and current trends (case study)
Common Agricultural Policy (CAP): the historical background and the origins; Towards a necessary reform; The Mac Sharry Plan - The first reform of the CAP; The Common Agricultural Policy and the World Trade Organization; Agenda 2000; The 2003 Reform; Health Check. The CAP after 2013: current structure, instruments and tools.

Unit 4 - Policy analysis framework
The Eightfold Path to policy analysis: define the problem; assemble some evidence; construct the alternatives; select the criteria; project the outcomes; confront the trade-offs; decide; tell your story.

Unit 5 - Policy evaluation (methods for agricultural policy analysis)
European Union: the Common Monitoring and Evaluation Framework (CMEF). FAO: The FAO approach to policy evaluation. "

Intended Learning Outcomes:
"Gained knowledge and objectives
Food systems encompass all the people, institutions and processes by which agricultural products are produced, processed and brought to consumers. They also include the public officials, civil society organizations, researchers and development practitioners who design the policies, regulations, programmes and projects that shape food and agriculture (FAO, 2013).

Public policy is the action taken by government to address a particular public issue. Local, regional, national, and international government organizations all craft and implement public policy to protect and benefit their populations addressing particular issues with a common long-term goal (Weimer D L, Vining A R, 2010).
Agricultural and food systems remain key sectors in any society (post-industrial societies, newly industrialized countries, emerging economies, low income countries) and they are strongly shaped by government actions in response to human needs, domestic and international pressures, social changes, climatic events.

This module is aimed at analyzing public policies in agricultural and food systems
The module will:
- define public policy and agricultural and food policy;
- identify the role of agriculture in the economy in high income, newly industrialized and low income countries;
- outline the policy process and the policy analysis evaluation framework;
- define the critical elements to conduct sound policy analysis (and design/implement sound policies);
- present a set of methodologies to conduct policy analysis.
"

Teaching and Learning Methods:
Lectures, seminars

Media:
Presentation slides, articles and short texts, student presentations

Reading List:
Unit 1 - Public policy formulation and design
Weimer D L, Vining A R (2010), Policy analysis, Longman (*).
FAO (2011), Food Security Communications Toolkit, Rome (*).

Unit 2 - Agricultural and food policy: definition, objectives, stakeholders, tools
OECD (2011), Agricultural Policy Monitoring and Evaluation 2011 - OECD COUNTRIES AND EMERGING ECONOMIES, Paris (Chapter 1 pp 23-35; Country chapter 6 pp 107-121).
James Pretty (2010), The top 100 questions of importance to the future of global agriculture, International Journal of Agricultural Sustainability, 8(4), pp. 219-236. (http://www.groupedebruges.eu/pdf/100questions_future-ag.pdf)

Unit 3 - The Common Agricultural Policy: history, development and current
EC (2004), The Common Agricultural Policy Explained, Brussels. (http://ec.europa.eu/agriculture/publi/capexplained/cap_en.pdf)
EC (2012), The Common Agricultural Policy. A partnership between Europe and Farmer, Brussels. (http://ec.europa.eu/agriculture/publi/capexplained/cap_en.pdf)
EC (2010), The Common Agricultural Policy after 2013 - Public debate - Summary Report, Brussels (http://ec.europa.eu/agriculture/cap-post-2013/debate/report/summary-report_en.pdf)

Unit 4 - Policy analysis framework
Eugene Bardach (2012), A Practical Guide to Policy Analysis: The Eightfold Path to More Effective Problem Solving, Chatham House Publishers, Seven Bridges Press (*).

Unit 5 - Policy evaluation (methods for agricultural policy analysis)
EC (European Evaluation Network for Rural Development) (2014), Capturing the success of your RDP: guidelines for the ex post evaluation of 2007-2013 RDPs, Brussels (*).
EC (European Evaluation Network for Rural Development) (2014), Glossary of key terms concerning evaluation, Brussels (*).
EC (European Evaluation Network for Rural Development) (2014), Guidelines on the mid-term evaluation of the rural development programmes, Brussels (*).
EC (European Evaluation Network for Rural Development) (2014), Establishing and implementing the evaluation plan of 2014-2020 RDPs, Brussels (*).
UNEG (2007), Evaluation in the UN System, Geneve (*).
Global Environment Facility Evaluation Office (2012), Peer review: the evaluation function of the Food and Agriculture Organization, Washington DC (*).
(*) Specific sections/chapters will be indicated during classes. Non attending students should ask to the lecturer."

Responsible for Module:
Matteo Vittuari matteo.vittuari@unibo.it>

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung
Agricultural Policies Evaluation
2 SWS
Matteo Vittuari
UNIBO
matteo.vittuari@unibo.it
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9304UB: Breeding for Sustainable Production | Breeding for Sustainable Production

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 2	**Total Hours:** 90	**Self-study Hours:** 70	**Contact Hours:** 20

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

Description of Examination Method:
Lectures are organized in two parts (frontal and lab practice).
Frontal lectures (12 hours): the first part is focused on the main breeding strategies in fruit tree species and the relative applications for plant sustainable production.
Lab practice (8 hours): the second part in the laboratory, to learn by experience a technique for DNA extraction and test plant DNAs by PCR by using markers linked to specific traits.
Assessment methods:

Oral exam. Students have to answer to the teacher questions about two of the arguments indicated in the course contents (including the practical experiences). This oral examination will make it possible to assess the achievement of the learning outcomes. The length of the exam will be about 30 minutes. The final grades will be calculated on the basis of the competences of the students, their correct use of the technical words, their ability to discuss with the teacher.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Students should have a background in agriculture and horticulture, all with knowledge about basic elements of genetics.

Content:
Frontal lectures (12 hours)
Introduction: basic concepts about fruit trees and implications in fruit tree breeding.
Strategies for conventional (double-pseudo test cross) and advanced (principles of in vitro culture, somaclonal variability and in vitro selection, development of molecular markers for MAS) breeding.

Overview of the main breeding goals for sustainable production and related applications:
- Breeding for resistance to biotic and abiotic stresses
- Breeding for low input production (habitus, self thinning and self-fertility)
- Breeding of rootstocks
Application of genetic transformation for sustainable production in fruit tree species

Lab practice (8 hours):
- Molecular marker analysis on a panel of genotypes for selected traits -

Intended Learning Outcomes:
Students have to demonstrate a good knowledge about the breeding approaches to select plant material suitable for the conditions where it has to be grown and with the right quality for the end-users. An increased yield is still the most important trait but sustainable plant production requires plant adaptation to abiotic stresses as well as resistance to pests and diseases. It is important for students to know the approaches for plant selection for specific traits.

Teaching and Learning Methods:
Frontal lectures, lab practice

Media:
Frontal lectures will be performed with the support of a videoprojector. Laboratory activities will be organised in a laboratory basically equipped for DNA analysis. All the material used for lectures (frontal or practical) will be made available for students.

Reading List:
Handouts and selected papers supplied by the lecturer.

Responsible for Module:
Luca Dondini luca.dondini@unibo.it

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Breeding for Sustainable Production
2 SWS
Luca Dondini
UNIBO
luca.dondini@unibo.it
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9309UB: Ecology of Insect Populations | Ecology of Insect Populations

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 45	**Contact Hours:** 45

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

Description of Examination Method:
Written/oral exam

Repeat Examination:

(Recommended) Prerequisites:
B.Sc.

Content:
Population ecology and the other ecological disciplines. Spatial distribution of organisms: random and aggregated distributions. Indexes of aggregation. Density-Invariant Indexes of Aggregation (Taylor's power law). Geostatistical Analysis of Population Distribution within precision agriculture. Using GIS in insect sampling. Estimation of population density and size: Simple Random and Stratified sampling. Two-step sampling and Sequential sampling. Survey, monitoring strategies and sampling techniques in entomology. Reproducing populations: exponential Model and logistic model. Life-tables and calculation of intrinsic rate of increase r. Models as analytical tool. Forecasting in IPM. Population models and the life-system approach. Phenological models in IPM. Prey-predator models: introduction to Lotka-Volterra model.

Intended Learning Outcomes:
The student will learn the quantitative population ecology of insects, including insect modelling, sampling and monitoring within IPM, and advanced methods like GIS-spatial data analysis within precision agriculture.

Teaching and Learning Methods:
Lectures, seminars, practical lessons with simulation software.

Media:

Reading List:
Power Point lessons dispensed by the teacher.
Other material, which is useful to consult:

Sharov A.: Quantitative population ecology, on line lectures. http://www.ento.vt.edu/~sharov/PopEcol/
Dent D.R. and M.P. Walton 1997: Methods in ecological & agricultural entomology- CAB International, 1997.
Southwood T.R.E.: Ecological methods. Methuen & Co LTD.
Jervis M., Kidd N.: Insect natural enemies. Practical approaches to their study and application. Chapman & Hall, 1996.

Responsible for Module:
Giovanni Burgio

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

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

Module Description

WZ9315UB: Fruit Cultivation in Mountain Areas | Fruit Cultivation in Mountain Areas

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 58	**Contact Hours:** 32

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

Description of Examination Method:
Oral exam (100% of the grade)
No learning aids will be allowed during the examination
Maximum duration of the exam: 45 minutes

Repeat Examination:
Next semester

(Recommended) Prerequisites:
B.Sc.

Content:
The course focuses on issues related to the management of fruit crop systems under mountain cultural and environmental conditions. The role of factors such as altitude, exposition, temperature range, field slope and water use on quality of mountain fruit products is described. Major topics include: berries (strawberry, blueberry, and raspberry), cherry, apricot, chestnut and grape.

Intended Learning Outcomes:
At the end of the course students will acquired knowledge on the orchard management and quality value of mountain fruit production. Students will be able to critically consider potentialities and limits for fruit production under a very peculiar and fragile environment such as the mountain context.

Teaching and Learning Methods:
Lectures, seminars, field activities

Media:
Power Point, selected scientific papers, scripts

Reading List:
Selected papers from international journals. Handout material and pdf of the lecture presentations available for students.

Responsible for Module:
Carlo Andreotti Carlo.Andreotti@unibz.it

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Fruit Cultivation in Mountain Area
2 SWS
Carlo Andreotti
UNIBZ
Carlo.Andreotti@unibz.it
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9305UB: Fruit Market Analysis and Consumer Behaviour | Fruit Market Analysis and Consumer Behaviour

Version of module description: Gültig ab summerterm 2013

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

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

Description of Examination Method:
"The course introduces students into the concepts and instruments of fruit market analysis and fruit consumption behaviour. The lectures serve to help students to build a theoretical and conceptual knowledge base. In addition, students will do their own research projects involving the preparation of market studies on individual fruit types. Depending on the participant number the studies may be done in teams. Finally, during an excursions students will acquire useful insights into the practical aspects of fruit markets and marketing. Students’ performance will be assessed as follows:
• final written exam (70%);
• student presentations (30%).
The written exam will be an answering-questions-type of test of 60-90 minutes of length."

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
BSc.

Content:
"The course covers the following topics:
1. Introduction
2. World and EU fruit markets
3. Fundamentals of marketing
4. Fundamentals of food consumer behaviour
5. Excursion
6. Market studies on individual fruits"

Intended Learning Outcomes:
Upon successful completion of the course, students will be able to:
• define key concepts of fruit market analysis and marketing;
• describe and critically discuss the main driving forces that determine fruit consumption behaviour
• apply their newly acquired knowledge and skills into market management practice.

Teaching and Learning Methods:
Frontal lecturers and learning-by-doing during the student projects

Media:
Power Point, e-learning platform "Reserve Collection", Scientific papers

Reading List:
The course materials consist of an international textbook and articles from relevant international scientific journals.
" Solomon, M., Bamossy, G. and Askegaard, S. (2009): Consumer Behaviour, European Edition, 4/ E. Prentice Hall / Financial Times Press. ISBN-13: 9780273717263
" Fruit market and consumer-oriented articles from academic proceedings collection and scientific journals

Responsible for Module:
Christian Fischer Christian.Fischer@unibz.it

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung
Fruit Market Analysis and Consumer Behaviour
2 SWS
Christian Fischer
UNIBZ
Christian.Fischer@unibz.it
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9307UB: Fruit Processing | Fruit Processing

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 0	**Contact Hours:** 90

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

Description of Examination Method:
"Written exam (100% of the grade)
No learning aids will be allowed during the examination
Maximum duration of the exam: 120 minutes"

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
mathematic, general chemistry, technical physic

Content:
The course will cover the following topics:
1) Introduction on fruit quality: chemical, biological and physical properties of fruits
2) Fresh cut fruit manufacturing
3) Fruit juice processing
4) Jam, jellies and marmelade processing
5) Role of pectins
6) Enzymatic treatments.

Intended Learning Outcomes:
Upon completion of the course, students are able to:
1) describe the flow diagram of the main fruit processing
2) identify critical steps in fruit processing and the consequence on fruit quality and safety 3) predict the effect of the process on fruit quality and shelf life through the use of kinetic models
4) comparing the effects of ingredients used in fruit processing for enhancing shelf life.

Teaching and Learning Methods:
To achieve the intended learning outcomes, students will 1) follow lectures and presentations delivered by the teacher; 2) perform practical problem solving excercise with the help of microprocessors and spreadsheets; 3) execute practical activities in the laboratory, mimicking common fruit processing operations.

Media:
Presentation slides, websites, articles and short texts

Reading List:
M. E. Dauthy 1995: Fruit and Vegetable Processing. FAO Agricultural Services Bulletin No.119 (ISBN 92-5-103657-8)

Responsible for Module:
Matteo Scampicchio matteo.scampicchio@unibz.it

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung
Fruit Processing
2 SWS
Matteo Scampicchio
UNIBZ
matteo.scampicchio@unibz.it
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9312UB: Fruit Tree Physiology | Fruit Tree Physiology

Version of module description: Gültig ab summerterm 2013

Module Level: Master	Language: English	Duration: one semester	Frequency: winter semester
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 45	**Contact Hours:** 45

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

Description of Examination Method:
Written final exam; Oral exam

Repeat Examination:

(Recommended) Prerequisites:
B.Sc.

Content:
Cell demography of fruit, its impacts on fruit sensorial attributes and quality traits. The determination and control of cropping potential by the environment. Sustainable methods of crop control: thinning, fruit growth, leaf photosynthetic potential.
Growth of fruit: definitions, modelling. Phloem unloading physiology and its relationship to the growth of the apple, the peach, the kiwifruit.
Precision fruit growing: fruit size forecast, and real time control of fruit growth by implementation of physiological knowledge into management practices.

Intended Learning Outcomes:
The acquired knowledge will provide the students in-depth knowledge of the tight relationships between fruit tree physiology and innovative, sustainable management methods that boost quality and productivity while reducing environmental impact.

Teaching and Learning Methods:
Lectures, seminars

Media:

Reading List:
Handouts and slide presentations provided by the instructor.
Selected readings from online resources.

Responsible for Module:
Luca Corelli

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

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

Module Description

WZ9316UB: Management of Mineral Nutrition in Orchards | Management of Mineral Nutrition in Orchards

Version of module description: Gültig ab winterterm 2014/15

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 56	**Contact Hours:** 34

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

Description of Examination Method:
The performance evaluation of the student consists of a final oral exam (100% of the grade).
No learning aids will be allowed during the examination
Maximum duration of the exam: 45 minutes"

Repeat Examination:
Next semester

(Recommended) Prerequisites:
BSc

Content:
The course encompasses major aspects of mineral nutrition of fruit plants: effects of nutrient availability on fruit tree growth, yields and fruit quality; nutrient needs nutrient partitioning, nutrient uptake dynamics; monitoring techniques of nutrient availability; supplying techniques that minimize the risk of environmental pollution (fertigation and foliar nutrition).

Intended Learning Outcomes:
The acquired knowledge will allow the students to develop sustainable methods to improve soil fertility in a sustainable way, reconciling productive and environmental aspects.

Teaching and Learning Methods:
Lecture: presentation of the lecture contends on slides using PowerPoint. Seminar Part: Discussion about selected chapters from Mineral Nutrition of Higher Plants. Field activities.

Media:
Presentation slides, websites, articles and short texts

Reading List:
Handout material available for students and selected chapters from Mineral Nutrition of Higher Plants , H. Marschner. Academic Press II ed.

Responsible for Module:
Stefano Cesco stefano.cesco@unibz.it

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Management of Mineral Nutrition in Orchards
2 SWS
Stefano Cesco
UniBz
stefano.cesco@unibz.it

Massimo Tagliavini
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Massimo.tagliavini@unibz.it
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9299UB: Nurseries and Orchards Design | Nurseries and Orchards Design

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 3	**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:
Oral exam

Repeat Examination:

(Recommended) Prerequisites:
B.Sc.

Content:
Organisation of nursery activity. Vegetative propagation: cutting, grafting, budding, and layering.
Rooting physiology and biochemistry.
Application of "in vitro" culture: Micrografting.
Tree production cycles in apple, pear, peach, apricot and cherry: knip trees and interstock technique. Growth regulators used in nursery. Biochemical aspect of graft-incompatibility
Strawberry: cold stored runner, fresh runners, try plant and waiting bed.
Physiological basis of irrigation. Modern technique of irrigation. Physiological basis of fruit tree pruning. Pruning model in fruit trees. Technique to control vigour and enhance fruit formation.

Intended Learning Outcomes:
Advanced knowledge of propagation techniques and production cycles of plants in nurseries
Knowledge of management of the orchard and the physiological processes of the plant.
Knowledge of techniques for manipulating the physiological processes such as pruning, application of growth regulators.

Teaching and Learning Methods:
Lectures, seminars

Media:

Reading List:
Lessons summary
Baldini, E. 1986: Arboricoltura generale. Clueb.
Hartmann H.T and D.E. Kester 1990: Propagazione delle piante. Basi scientifiche e applicazioni tecniche. Edizioni Agricole, Bologna.

Responsible for Module:
Stefano Mussacchi

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

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

Module Description

WZ9310UB: Organic Fruit Production | Organic Fruit Production

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 45	**Contact Hours:** 45

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

Description of Examination Method:
Oral exam

Repeat Examination:

(Recommended) Prerequisites:
B.Sc.

Content:
The class will focus on the organic management of the most important fruit tree species of the region (peach, pear, apple, kiwifruit, strawberry, grape, etc.). History of the organic agriculture, development and economical importance of the cultivation management in Italy and in the world. Importance and strategies to increase the biodiversity in the farm, in the orchard and in the soil. The most appropriate varieties and rootstocks in regards to the environment of cultivation. Training systems, tree density, soil management, nutrient and water management in the organic cultivation system. Organic fertilizers. The production of composts from the recycling of organic waste disposals. The role of soil organic matter and the strategies to increase its concentration in the soil. The use of natural aqueous extracts in orchard managements. The difference of fruit quality in relation to organic, integrated and conventional cultivation systems. The market of organic fruits and the consumer opinion.

Intended Learning Outcomes:
The class aims to provide the students with the knowledge of: the organic fruit tree cultivation, the most common problems of this cultivation system, the tool to prevent or overcome them. In order o build up the skills for a correct orchard plantation and management (irrigation, fertilization, pruning, thinning, harvesting), to increase the quality of the final product and the environment.

Teaching and Learning Methods:
Lectures, seminars, visit to orchards and processing plants. Seminars by experts

Media:

Reading List:
Relevant articles in scientific journals

Responsible for Module:
Moreno Toselli

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

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

Module Description

WZ9313UB: Plant-Probiotic Microorganisms: the Basis of Sustainable Agriculture | Plant-Probiotic Microorganisms: the Basis of Sustainable Agriculture

Version of module description: Gültig ab summerterm 2013

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

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

Description of Examination Method:
Written/oral exam, laboratory report

Repeat Examination:

(Recommended) Prerequisites:
B.Sc.

Content:
The course is designed to update master students knowledge and laboratory skills about the largely untapped approach to improving productivity of crop plants: harnessing plant-probiotic microorganisms, those which render each plant a super-organism. Both beneficial (nutritional, defensive, regulatory) and antagonistic (biocontrol) functions will be dissected, together with detection and monitoring microbiological methods based on culturing and metagenomic approaches.

Intended Learning Outcomes:
After completing the course, the student holds a scientific roadmap on how to exploit natural soil microbial resources to reducing agrochemicals, breed sustainable varieties, decreasing the cost and improving the quality of horticultural crops.
Knowledge and ability to improve horticulture sustainability by exploiting plant-probiotic microorganisms.

Teaching and Learning Methods:
Lectures, seminars, labs

Media:

Reading List:
Handout materials will be available for students during the lectures, labs and selected chapters from Dessaux, Hinsinger, Lemanceau (eds.):"Rhizosphere: Achievements and Challenges" (2010). Springer. ISBN: 9789048128556.

Responsible for Module:
Marco Bosco

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

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

Module Description

WZ9302UB: Post-harvest Management | Post-harvest Management

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 45	**Contact Hours:** 45

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

Description of Examination Method:
written examination and laboratory report

Repeat Examination:

(Recommended) Prerequisites:
B.Sc.

Content:
Fruit quality definition along the productive chain
Fruit ripening and maturation syndrome
Cold Storage (traditional and innovative techniques)
Fruit quality assessment: traditional and non-destructive methods (NIRs; Electronic nose; etc)
Methods to control ripening evolution

Intended Learning Outcomes:
The course will aim to improve the knowledge of the fruit quality management in pre- and post-harvest conditions. At the end of the course students will have a deep knowledge on the concept of quality of fruits and vegetables, and about the tools for traditional and non-destructive determination of the organoleptic quality of fruits

Teaching and Learning Methods:
Lectures, laboratory experiment

Media:

Reading List:
Handouts and selected papers

Responsible for Module:
Guglielmo Costa

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

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

Module Description

WZ9311UB: Soil Fertility | Soil Fertility

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 48	**Contact Hours:** 42

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

Description of Examination Method:
Written/oral exam, short paper (maximum 10.000 characters including spaces and references)

Repeat Examination:

(Recommended) Prerequisites:
B.Sc.

Content:
Soil biochemistry: soil enzymes. Main enzymatic activities involved in soil fertility and plant nutrition.
Nitrogen cycling: fixation, mineralization, immobilization, organication, nitrification and denitrification. Phosphate cycling: mineralization of the organic phosphorus. Sulphur cycling: reduction of sulphate and oxidation of sulphur. Potassium, calcium and magnesium. Micronutrients. Iron nutrition (strategies I and II). Mineral nutrition and soil analysis: concept of bioavailable nutrients.
Cations and anions in soil: concentration in soil solution, solubility, role of the pH and the redox potential. Complexation and chelation of metals: properties of the complexes/chelates.
The rizosphere: root exudates and their biological activity. Soil-root interaction in rhizospheric soil.
Soil fertilization: fertilizers, classification, national and European legislations. Factors affecting fertilizers uses. Criteria to assess nitrogen mineralization of organic fertilizers and amendments.
Evaluation of the soil fertility. Organic farming. Recycling and use of biomasses of agro-industrial origin in agriculture.

Intended Learning Outcomes:
The student at the end of the course will get the ability to evaluate the soil fertility from a physical, chemical and biochemical viewpoint.

Students shall be able to manage it and to increase it, if necessary, according to the target of production fixed and environmental aspects.

Teaching and Learning Methods:
Lectures, seminars, lab

Media:

Reading List:
Mengel K. and Kirkby E. A. (2001): Principles of Plant Nutrition. 5th Ed. Pp. 849. Kluwer Academic Publishers, Dordrecht, Boston, London.
Marschner H. (1995): Mineral Nutrition of Higher Plants. 2nd Ed. Academic Press.

Responsible for Module:
Claudio Ciavatta

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

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

Szent István University Budapest | Szent István University Budapest

Module Description

WZ9161SZI: Applied Entomology | Applied Entomology

Version of module description: Gültig ab summerterm 2016

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 108	**Contact Hours:** 42

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

Description of Examination Method:
In the 60 min. of examination the students will show that the have learned to discriminate 8 arthropod orders and 37 families of horticultural pests, to understand the biology, behaviour, and ecology of 53 key pests in horticulture. Students are expected to recognize these 53 key pest species in their adult form or based on their damage symptoms, as well as 9 larval and 3 pupal forms of holometabolous insects. Students will also show that they understood the different tactics used in horticultural pest-management programs, the biology, behaviour and ecology of key natural enemies of pests, learned control tactics for managing pests and their advantages and limitations, gained an understanding of pest management in several model systems including grapevine, fruit, vegetable and ornamental crops. Recognition of these key pests and their damage symptoms will be a major part of the exam. In the second part of the exam the student will prove his/her knowledge about the management tactics of key horticultural pests.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Botany (Basic entomology would also be helpful, but not required)

Content:
Key pests and their damage symptoms are introduced from our insect collection. The use of compound microscopes in the course is necessary. Schedule:
Week 1 General introduction
Week 2 Orthoptera and Thysanoptera
Week 3 Hemiptera 1
Week 4 Hemiptera 2

Week 5 Hemiptera 3
Week 6 Some larval and pupal forms of holometabolous insects
Week 7 Lepidoptera 1
Week 8 Lepidoptera 2
Week 9 Coleoptera 1
Week 10 Coleoptera 2
Week 11 Diptera
Week 12 Hymenoptera
Week 13 Prostigmata
Week 14 Biological pest management

Intended Learning Outcomes:
The student will learn to distinguish 53 key pest species in their adult form or based on their damage symptoms, as well as to recognize 9 larval and 3 pupal forms of holometabolous insects. The student will also understand the different tactics used in horticultural pest-management programs, understand the biology, behaviour and ecology of key natural enemies of pests, learn control tactics for managing pests and their advantages and limitations, gain an understanding of pest management in several model systems including grapevine, fruit, vegetable and ornamental crops

Teaching and Learning Methods:
Presentation of PowerPoint slides and occasionally video films about the ecology or management of pests

Media:
The presentations and excerpts from a book about general entomology are available to students in flash and pdf format, respectively.

Reading List:
Ciancio A. and Mukerji K. G. (eds.) (2007): General concepts in integrated pest and disease management. Springer, Dordrecht, The Netherlands, pp. 359.; van Emden H.F. (2013): Handbook of agricultural entomology. John Wiley and Sons, Chichester, West Sussex, UK, pp. 312.

Responsible for Module:
József Fail (jozsef.fail@kertk.szie.hu)

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

József Fail (jozsef.fail@kertk.szie.hu)
Gábor Vétek (gabor.vetek@kertk.szie.hu)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9336SZI: Biology and Cultivation of Fungi | Biology and Cultivation of Fungi

Version of module description: Gültig ab summerterm 2016

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 4	**Total Hours:** 120	**Self-study Hours:** 75	**Contact Hours:** 45

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

Description of Examination Method:
To accomplish the course, we're asking three student's 'product'
- a vocabulary test, with the frequently used phrases needed for mushroom cultivation (10 min.)
- 10 minutes long presentation about chosen mushroom cultivation topic with discussion
- written test from the studies (60 min.)
Based on the collected point, we offer an exam note. If the student do not accept it, there is a chance to write a new test.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Basic knowledge of fungal taxonomy and biology

Content:
The course will give a general overview about mushroom cultivation technologies. A strong biological basis (life cycle of Basidiomycetes, enviromental conditions, fungal development, etc) needed for the course. The student will have a look into mushroom spawn production, compost preparation, cultivation, pest and disease management of the crop. We discuss the three major edible fungus genus (Agaricus, Pleurotus, Lentinula) cultivation opportunities, in addition some medicinal genus (Ganoderma, Coprinus) also mentioned.
1. First discussion: schedule, exam. Introduction into mushroom industry
2. Mushroom biology
3. Nutritional value of edible mushrooms
4. Spawn preparation, post-harvest
5. Laboratory practice
6. Agaricus 1.: Composting technology

7. Agaricus 2.: Cultivation
8. Shiitake cultivation
9. Other edible mushrooms
10. Oyster cultivation
11. Mycorrhizal fungi
12. Mushroom integrated pest management

Intended Learning Outcomes:
After the student has sucessfully passed the lecture he/she - can recognize the most common edible mushroom,
- knows about biological needs of mushroom-substrate preparation methods and techniques-identifying of most common pests and diseases at mushroom farms

Teaching and Learning Methods:
Every week a seminar and a laboratory practice with weekly observation in our mushroom research unit

Media:
Presentations, videos

Reading List:
http://kertesztananyag.hu/modern-mushroom-cultivation-technologies
Chang S.T., Miles P.G. (2004) Mushrooms – Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact. CRC Press, USA.
Stamets P. (2000) Growing Gourmet and Medicinal Mushrooms. Ten Speed Press, Toronto: 208-216

Responsible for Module:
Anna Szabó (anna.szabo@kertk.szie.hu)

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

Anna Szabó (anna.szabo@kertk.szie.hu)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9333SZI: Evaluation of Fruit Cultivars | Evaluation of Fruit Cultivars

Version of module description: Gültig ab winterterm 2012/13

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 3	**Total Hours:** 120	**Self-study Hours:** 75	**Contact Hours:** 45

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

Description of Examination Method:
Practical exam, oral exam

Repeat Examination:

(Recommended) Prerequisites:
Basic knowledge (BSc) in botany, production, plant propagation, physiology, genetics and breeding.

Content:
Consideration in utilisation of varieties. Evaluation of cultivars: methods, results. Consumer's point of view. Evaluation of resistance. Identification by molecular screening. Blossoming and fertilization specialities of fruits. Traditional and new cultivars. Metaxenia.

Intended Learning Outcomes:
Students get knowledge how to choose appropriate cultivars and their connections, which determine profitability of cultivation.

Teaching and Learning Methods:
Lecture, laboratory

Media:

Reading List:
Tóth, M. (ed.) Progress in Apple Breeding and Evaluation of Gene Resources. Special number of International Journal of Horticultural Science.. ISSN 1585-0404. 2005.

Tromp, J. (ed.) Fundamentals of Temperate Zone Tree Fruit Production. Backhuys Publishers, Leiden. 2005.
Morgan, J., Richards, A. The new Book of Apples. Ebury Press, London. 1993.
Götz, G. & R. Silbereisen. Obstsorten Atlas. Ulmer, Stuttgart. 1989.

Responsible for Module:
Magdolna Tóth

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

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

Module Description

WZ9355SZI: Existing Trends of Organic Farming in Practice | Existing Trends of Organic Farming in Practice

Version of module description: Gültig ab summerterm 2016

Module Level:	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 2	**Total Hours:** 90	**Self-study Hours:** 45	**Contact Hours:** 45

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

Description of Examination Method:
During the semester 1 written exam is evaulated consisting of 12 questions. Presentation of design work of a sustainable farm or garden.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Basic information about agriculture and horticultural.

Content:
The aim of the course is to make students familiar with principles and developement of organic farming, and the most important trends, and movements in Europa and in world wide. The studenst will be familiar with sustainable farming systems like: permaculture, agroforestry systems, Fukuoka systems, Bio-Organic farming. Applying the theoretical knowledge of the course, students have the possibility to make a design of a sustainable farm or garden
according to one of the most well known trends of organic farming, like permaculture.

Intended Learning Outcomes:
The students document solid knowledge in organic farming. They demonstrate insight in technologies, aims and applications thereof. They testify knowledge in organic farming and are capable to understand technological approaches based on given pathways. Applying knowlegde on the right place, Trying new ideas, solutions based on scientific results. Sytem approach

Teaching and Learning Methods:
Lecture, presentation of the lecture contends on slides using PowerPoint, seminar talks also assisted by PowerPoint. Movies, film about introduction of different trends of Organic farming.

Media:
Prepared ppt sides of the lectures are available on-lne.
Movies about presentatuion of different kind of trends of organic farming.

Reading List:
B. Sarapatka J. Urba: Organic Agriculture (2009) Prague ISBN: 978-80 86671-69-7
Mollison B: Permaculture manual handbook 2001 Tagari press Ausztrália
Mollison B. Introduction to permaculture (1991) Tagari press Ausztrália
Altieri M: Agroecology (1989) Cambridge University press
Whitfiled P: How to make a forest garden Permanent publications 1996

Responsible for Module:
Zita Szalai (magdolnazita.szalai@uni-corvinus.hu)

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

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

Module Description

WZ9151SZI: Genetics and Plant Breeding | Genetics and Plant Breeding

Version of module description: Gültig ab summerterm 2016

Module Level: Bachelor	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 4	**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:
2 tests during the semester

Repeat Examination:

(Recommended) Prerequisites:

Content:
Nowadays, requirement for the study of genetics is increasing everywhere around. The aim of the course is transmitting the basic genetics knowledge indispensable to understand the main streams in the modern biology and plant breeding. The first part of the course spans the problems of classical and molecular genetics. The second part offers the brief survey plant breeding methods including the up to day results of biotechnology.

Intended Learning Outcomes:
Information obtained during the course help students to be familiar with the different type of cultivars used in the horticultural production.

Teaching and Learning Methods:

Media:

Reading List:
Recommended readings:

Rattan Lal Agrawal: Fundamentals of plant breeding and hybrid seed production. Science Publishers, Inc. USA, 1998.
Edited by Nigel G. Halford: Plant biotechnology. Current and future applications of genetically modified crops. John Wiley & Son, Ltd., 2006
A.J. Richards: Plant breeding systems. Chapman & Hall, 1997
Klug WS., Cummings MR., Spoencer CA. 2006. Concepts of genetics. Pearson Education Inc. London

Responsible for Module:
Hegedűs Attila (Hegedűs Attila <hegedus.attila@uni-corvinus.hu>)

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

Olah Robert (robert.olah@uni-corvinus.hu)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9341SZI: Horticultural Dendrology | Horticultural Dendrology

Version of module description: Gültig ab summerterm 2016

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 45	**Contact Hours:** 45

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

Description of Examination Method:
The number and type of tests in semester
Plant identification tests:
1. Decidious ornamental trees and shrubs (see at lessons and practical classes).
2. Evergreens (see at lessons and practical classes). The students, who fulfilled the requirements of the semester, have to register for the written and oral exam in the NEPTUN System. The test material includes the complete curriculum. The exam starts with a written one. If it is successfull and gives mark 3 or better, the students are offered an exam mark in which the participation and the results of plant identification tests during the semester are also taken in consideration. If the written exam has mar 2 (or the student is not satisfied with the offered exam mark), an oral examination follows which decides the mark of the exam.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Botany, Nursery

Content:
The course provides general training in key areas of horticultural dendrology and urban horticulture. Introduction to Horticultural Dendrology. Requirements, available books, CD-s and the Buda Arboretum. Visit to Hortus Hungaricus or OMÉK (International Horticultural Exhibitions and Trade Fair). The Buda Arboretum, I. History, environment, Woody plant and perennial plant collections. Plant knowledge practices. Broadleaved trees and shrubs. Visit to an ornamental nursery. Visit to International Dendrological Foundation to Budakeszi. Conifers. Knowledge of evergreens. Growing and propagation of woody ornamentals. Planting and pruning of woody ornamentals, tree surgery.

Intended Learning Outcomes:
The students have knowledge of woody ornamental plants, know the use and maintenance processesof the woody ornamental plants.

Teaching and Learning Methods:
Lecture, presentation of the lecture contends on slides using PowerPoint, seminar talks also assisted by PowerPoint, prakticum in Buda Arboretum, visit in nursery and herbarium.

Media:
Slides of the lecture are available online.

Reading List:
*** (1991): The Hillier Manual of Trees and Shrubs. Hillier Nurseries Ltd., Ampfield, Romsey (England)
BÄRTELS, A. (1989: Gehölzvermehrung. Ulmer Verlag, Stuttgart
BÄRTELS, A. (1995): Der Baumschulbetrieb. Ulmer Verlag, Stuttgart
Dirr, M. A (1998): Manual of Woody Landscape Plants. Stipes Publ. Company, Champaign, Ilinois, USA.
Hoffman, M. H. A. (2005): List of Names of Woody Plants. International standard ENA 2005-2010, Applied Plant Research. Boskoop, the Netherlands.
KRÜSSMANN, G. (1978): Die Baumschule. Paul Parey Verlag, Berlin-Hamburg
Krüssmann, G. (1985): Manual of Cultivated Conifers. Timber Press, Portland, Or., USA.
Krüssmann, G. (1989): Manual of Cultivated Broad-leaved Trees and Shrubs. Timber Press, Portland, Or., USA.
Krüssmann, G. (1990): Manual of Woody Landscape Plants. Stipes Publ. Company, USA.
MACDONALD, B. (1989): Practical Woody Plant Propagation for Nursery Growes. B. Y. Batsford Ltd., London

Responsible for Module:
Magdolna Sütöri-Diószegi (magdolna.dioszegi@uni-corvinus.hu)

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

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

Module Description

WZ9357SZI: Hungarian Grape Varieties and Hung. Wine Terroirs | Hungarian Grape Varieties and Hung. Wine Terroirs

Version of module description: Gültig ab summerterm 2016

Module Level: Bachelor/Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 4	**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:
written tests and oral presentation

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Basic knowledge about plant production and viticulture is proposed.

Content:
The history of the grapevine growing dates back to the ancient time. According to the archaeological evidences the earliest wine production dated around 8000 BC, in Georgia, Iran, and Armenia. The production spread from these places to Egypt, Greece and to the Roman Empire, from where to West and Central Europe, and other continents.
Nowadays grapevine growing area of Hungary is around 69.000 ha, in 22 wine regions.
This course handles the history and the current status of the wine regions of Hungary and autochthonous grapevine varieties.

Intended Learning Outcomes:
Knowledge about the past and present of the Hungarian viticulture sector: wine regions, cultivars. Within this course students get knowlegde about the local Hungarian grapevine cultivars and the special Hungarian wine terroirs.

Teaching and Learning Methods:

Media:

Reading List:

Responsible for Module:
Péter Bodor (bodor.peter@uni-corvinus.hu)

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

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

Module Description

WZ9325SZI: Molecular Genetics and Gene Technology of Plants | Molecular Genetics and Gene Technology of Plants

Version of module description: Gültig ab summerterm 2016

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 45	**Contact Hours:** 45

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

Description of Examination Method:
2 tests during the semester

Repeat Examination:

(Recommended) Prerequisites:

Content:
The course provides detailed information on plant molecular genetics (structure and function of biomolecules, gene structure and function, genetic control of gene expression) and gene technology. The application of basic knowledge to improve plant varieties using both classical breeding methods and up-to-date techniques of biotechnology is also highlighted. The development, application and evaluation of specific molecular markers form also crucial parts of the course. The basics of genetic transformation are also covered ranging from plant tissue and cell culture to the methods of gene tranfer and detection of transgenes.

Intended Learning Outcomes:
Information obtained during the course helps students to understand the genetic background of biotechnology and provides the ability to asses its values and risks.

Teaching and Learning Methods:

Media:

Reading List:
Recommended readings:
Patthy, L. 2008. Protein evolution, 2nd ed. Blackwell Oxford
Halford, N.G. 2006. Plant biotechnology. Current and future applications of genetically modified crops. Wiley New York
Weising, K., Nybom, H., Wolff, K., Kahl, G. 2005. DNA fingerprinting in plants. CRC Press Boca Raton
Buchanan, B.B., gruissem, W., Jones, R.L. 2015. Biochemistry and molecular biology of plants, 2nd edition. Wiley New York

Responsible for Module:
Attila Hegedus (hegedus.attila@uni-corvinus.hu)

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

Robert Olah (robert.olah@uni-corvinus.hu) Julia Halasz (julia.halasz@uni-corvinus.hu)
Zsuzsanna Benyone Gyorgy (zsuzsanna.gyorgy@uni-corvinus.hu)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9217SZI: Plant Geography and Plant Ecology | Plant Geography and Plant Ecology

Version of module description: Gültig ab summerterm 2016

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 3	**Total Hours:** 150	**Self-study Hours:** 108	**Contact Hours:** 42

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

Description of Examination Method:
The students document knowledge on biodiversity of plants, the origin and distribution of plant species, with special account on the cultivated species. They demonstrate insight in plants' structure and function as basis for adaptation. They testify knowledge in how to evaluate ecosystem functions and should be capable to understand individual and population behaviour in different environmental conditions. They decide the best applications of plants without deteriorating the ambience.

Repeat Examination:

(Recommended) Prerequisites:
Basis of botany; anatomy and morphology of plants as well as taxonomy.

Content:
The module consists of a lecture (2SWS) and a practical (1SWS). The lectures give insights into the World's biodiversity; hot spots, floristic kingdoms, origin and distribution of plants species, with special account on cultivated plants. The topic of plant ecology refers to species' tolerance in relation to the environment; the niche concept. Main characteristic of plant populations; structure, function and population dynamics. Different forms of adaptation, propagation and dispersal of plants influenced by the environmental factors. During the course are revised subjects in morphology, anatomy, taxonomy of plants. This knowledge altogether contributes to better understanding plant behaviour, how plant species react to changes of the environment. A main topic of the course is to get acquainted with ecosystem functioning; ecosystem services and attributes in a man mediated environment. Weeds and the threats by plant invasion are discussed. Description of biomes with their most characteristic vegetation and the functional groups of species therein. Basic succession events are discussed and degradation in ecosystems. At the end a

summary is presented how the ecological-floristical knowledge contributes to plan the best and the most effective horticultural terrain. Practical include visits in different vegetation zones of Hungary from the forest-steppe to closed forests of Europe by evaluating the horticultural potential of the territory.

Intended Learning Outcomes:
Upon completion of this module students are able to understand the functioning of natural and human mediated ecosystems and to assess their important attributes, to evaluate ecological background of different horticultural sites. Moreover, they also have knowledge on sustainable ecosystems and how long-term services are maintained.

Teaching and Learning Methods:
Höhn M. (2013): Botany: chapters IV, V, VI, VII, VIII, IX, X. In: Éva Németh Zámboriné, Szilvia Sárosi, Levente Horváth : Modern Horticulture. Corvinus University of Budapest, Faculty of Horticultural Science, 2013. (ISBN: 978-963-503-552-6)

Media:
ppt of the lectures are available

Reading List:

Responsible for Module:
Maria Höhn (maria.hohn@uni-corvinus.hu)

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

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

Module Description

WZ9316SZI: Plant Physiology and Plant Molecular Biology | Plant Physiology and Plant Molecular Biology [3MN24NAK06M]

Plant Biochemistry and Plant Physiology

Version of module description: Gültig ab summerterm 2016

Module Level: Bachelor/Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 48	**Contact Hours:** 42

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

Description of Examination Method:
The interactions of plant and its abiotic environment are highlighted by treating the following subject areas: General overview of interactions between plants and their abiotic environment. Water and mineral nutrient transport in the changing environment. Sensing of internal and external signals, transduction pathways and networks, role of plant hormones. Non-photosynthetic effects of light, consequences of extreme temperature and salt exposure. Levels and types of adjustments to external conditions, tolerance strategies. Molecular background and regulation of circadian and photoperiodic rhytmhs. Description of processes leading to flowering, seed and fruit development in the molecular level in the light of external and internal regulators.

Repeat Examination:

(Recommended) Prerequisites:

Content:
The course deals with the most important physiological processes of plants and their molecular biological bases. During the course students gain theoretical knowledge and get practical experience about the most important life processes of plants.
Aims, objectives and description of the course:
The course is centered around the following topics: transport processes in plants, regulation of physiological functions, impact of some environmental factors and the generative phase of plants. The main areas studied are: mineral nutrition, xylem and phloem transport, growth and development, signaling and hormones in plants, the effect of light and temperature, photoperiodism, flowering, fruit- and seed physiology.

The course contains laboratory practice, where instrumental methods are used to study effects of water stress, plant pigments of flowers and other plant parts are analyzed, in vitro techniques are introduced and hormonal actions in plants are demonstrated.

Intended Learning Outcomes:

Teaching and Learning Methods:

Media:

Reading List:
Compulsory literature:
- online teaching material available through the e-learning system of SZIU
- Eds Taiz and Zeiger, Plant Physiology, Sinauer 3rd ed. 2002
Recommended literature:
- Eds Buchanan et al, Biochemistry and Molecular Biology of Plants, ASPP 2000

Responsible for Module:
István Papp (istvan.papp2@uni-corvinus.hu)

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

Dr. István Papp, professor, DSc, Kissné Dr. Erzsébet Bába PhD, assistant professor, Dr. Anita Szegő PhD, assistant professor
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9363SZI: Plant Stress Physiology | Plant Stress Physiology

Version of module description: Gültig ab summerterm 2017

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

WZ9340SZI: Production of Propagation Material of Vegetables | Production of Propagation Material of Vegetables [3ZT14NBV43M]

Module offer of Szent István University Budapest

Version of module description: Gültig ab summerterm 2016

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 4	**Total Hours:** 120	**Self-study Hours:** 75	**Contact Hours:** 45

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

Description of Examination Method:
Written exam

Repeat Examination:

(Recommended) Prerequisites:
Basic knowledge (BSc) in botany, vegetable study, plant production, propagation, physiology, techniques and nutrition.

Content:
During the course the students learn the Hungarian and international rules and regulations of the seed production industry. They are introduced to the most significant players and companies of the sector. The students learn about seed quality control; treatments and packaging.

Intended Learning Outcomes:
Students gain special knowledge to be able to get job in at propagation enterprises, seed producing firms and legal control institutes, but also in international trade.

Teaching and Learning Methods:
Lecture, laboratory, excursion

Media:
exam

Reading List:
Compulsory literature:
1. Rubatzky, V. E., Yamaguchi, M. (1997): World Vegetables. 2nd ITP. New York. Albany. ISBN: 9781461560159
Recommended literature:
1. Raymond, A. T. George (2009): Vegetable seed production, CABI.
2. Raymond, A.T. George (2011): Agricultural seed production, CABI.

Responsible for Module:
Katalin Peregi-Ertseyné

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

Dr. Gábor Balázs, Dr. Anna Szabó, Dr. Zoltán Pap, Dr. András Geösel, Dr. Anna Divéky-Ertsey
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9160SZI: Resources of Viticulture | Resources of Viticulture

Version of module description: Gültig ab summerterm 2016

Module Level: Master	**Language:** 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:
Students are writing a test at the end of semester and preparing an essay in a viticulture-related topic. Based on the grading of the test (60%) and the essay (40%) the final grade will be determined, which can be improoved by an oral exam during the exams period.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Basic knowledge in Viticulture

Content:
High quality fruit is the basis of quality wine production. To achieve proper fruit quality, well designed and physiologically grounded phytotechnical management (pruning and canopy management) has to be carried out. The course handles essential knowledge of the background and recent trends of the grape and wine sectors and practical viticulture based on solid knowledge of grapevine biology.
During the course we are covering origin and morphology of the grapevine, physiological and genetic background of viticulture, furthermore specific phytotechniques applied in the vineyard.

Intended Learning Outcomes:
After sucessfully passing, students have detailed knowledge about biological and technical aspects of the technological steps in a vineyard. They are able to understand deviations from normal plant development and analyze possible causes.

Teaching and Learning Methods:
teaching methods: lecture, practical part with plants and plant parts.
learning methods: - to define the crop quality, - to recognize caused damages, their pathogen and develop phytotechnical management solutions,

Media:
Presentation slides are available online

Reading List:
Keller, M (2010) The Science of Grapevines, Academic Press – Elsevier

Smart, R. E. (1985) Principles of grapevine canopy microclimate manipulation with implications for yield and quality. A review. American Journal of Enology and Viticulture 36: 230-239. p.

Coombe, B. G. and Dry, P. R. (2000) Viticulture 1-2. Winetitles, Adelaide, Australia

Responsible for Module:
Tamás Deák (tamas.deak@uni-corvinus.hu)

Courses (Type of course, Weekly hours per semester), Instructor:
Theoretical, Biological and phytotechnical resources of viticulture, 2 SWS
Practical, Biological and phytotechnical resources of viticulture (P), 1SWS
Tamás Deák (tamas.deak@uni-corvinus.hu)
Péter Bodor (bodor.peter@uni-corvinus.hu)
György Lukácsy (gyorgy.lukacsy@uni-corvinus.hu)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9334SZI: Special Plant Compounds in Nutrition and Therapy | Special Plant Compounds in Nutrition and Therapy

Version of module description: Gültig ab summerterm 2016

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 4	**Total Hours:** 90	**Self-study Hours:** 45	**Contact Hours:** 45

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

Description of Examination Method:
Written exam, individual report

Repeat Examination:

(Recommended) Prerequisites:
Basic knowledge (BSc) in biochemistry

Content:
Secondary compounds in plants. Their biological activity. Safety requirements, toxicity, side effect, interactions. Quality documentation, quality aspects. Food additives, dietary supplements. Traditional medicinal products (according to EU). Natural dyes. Reform nutrition.

Intended Learning Outcomes:
Getting well established knowledge on plants and plant materials which students meet in everyday life. Possibilities of their application, international trends and regulations.

Teaching and Learning Methods:
Lecture, laboratory

Media:

Reading List:
Gaedcke, F., Steinhoff, B. and Blasius, H. Herbal medicinal Products. Medpharm Scientific Publishers, CRC Press, USA, pp. 177. 2000.

Mills, S. and Bone,K. The essential guide to herbal safety. Elsevier, USA. pp. 684. 2005.
Schilcher, H., Kammerer,S. Leitfaden phytotherapie. Urban and Fischer Verlag, München-Jena, pp. 966. 2000.

Responsible for Module:
Jeno Bernáth

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

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

Module Description

WZ9374SZI: Sustainable Crop Production | Sustainable Crop Production

Version of module description: Gültig ab summerterm 2018

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

WZ9335SZI: Up-to Date Technologies of Medicinal Plant Production | Up-to Date Technologies of Medicinal Plant Production

Version of module description: Gültig ab summerterm 2016

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 4	**Total Hours:** 5	**Self-study Hours:** 2	**Contact Hours:** 3

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

Description of Examination Method:
Based on the lectures, own experiences and literature review, the students prepare a homework on certain technology elements (cultivation, processing, etc.) of a medicinal plant or a growing area of their home countries. The homework is to be submitted in electronic form and presented at the end of the semester. A written exan is also included as a part of the term mark. An average of the homework and the written exam is calculated to achive the final result of the course.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:

Content:
Biological bases of medicinal plant production, effective forms of small and large scale production are demonstrated. Intensive and extensive growing systems as well as climatic and soil conditions, agroecological potential of growing sites,influencing medicinal crop production are also part of the teaching program. Propagation and other elements of growing technologies specified for medicinal plant production, new fertilizers, growth regulators and pesticides lisenced for medicinal plant cultures are also presented. Modern harvesting technologies and post harvest treatments, quality assurance and standards of medicinal plant production are included as well.

Intended Learning Outcomes:
Students fulfilling the course requirements will get an insight to the growing conditions of medicinal plants, specific requirements and characteristics concerning cultivation elements. They will be able to make plans for some elements of medicinal plant growing.

Teaching and Learning Methods:

Media:

Reading List:

Responsible for Module:
Zsuzsanna Pluhár (zsuzsanna.pluhar@uni-corvinus.hu)

Courses (Type of course, Weekly hours per semester), Instructor:
lecture, null, 2SWS
practice, null, 1SWS
Eva Németh (eva.nemeth@uni-corvinus.hu) Péter Radácsi (peter.radacsi@uni-corvinus.hu)
Beáta Gosztola (beata.gosztola@uni-corvinus.hu)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9145SZI: Wine Terroirs | Wine Terroirs

Version of module description: Gültig ab summerterm 2016

Module Level: Bachelor/Master	**Language:**	**Duration:** one semester	**Frequency:** winter semester
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:
written tests and oral presentation

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Basic knowledge about plant production and viticulture is proposed.

Content:
This course introduces the most important grapevine growing countries in the world. Description of the most important climatic, topographic aspects of the countries related to viticulture. History and present of the grapevine growing. Local cultivars and traditional cultivation practices.

Intended Learning Outcomes:
Knowledge about the past and present of the world’s viticulture sector: wine regions, cultivars. Within this course students get knowlegde about the local grapevine cultivars and the special wine terroirs.

Teaching and Learning Methods:

Media:

Reading List:

Responsible for Module:
György Lukácsy (gyorgy.lukacsy@uni-corvinus.hu)

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

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

University of Natural Resources and Life Sciences Vienna | Universität für Bodenkultur Wien

Module Description

WZ9344BOK: Ecological Basis of Biological Control | Ecological Basis of Biological Control

Version of module description: Gültig ab summerterm 2015

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

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

Description of Examination Method:
In an oral examination (120 min) the students are showing their knowledge of the behavior and ecology of agriculturally relevant arthropods. Their understanding why, and under which circumstances, organisms may cause damage on crops and how these pest organisms can be controlled by natural/biological means. And their understanding of the need for multi-trophic view in plant protection.

Repeat Examination:

(Recommended) Prerequisites:
Basic knowledge in ecology, biology, plant protection, agriculture, entomology

Content:
Definition and scope of biological control, arthropod ecology, basic ecological interactions, population ecology incl. mathematic models, resistance development, ecology and behavior of selected natural enemies,multitrophic interactions, direct and indirect plant defence, case studies from agriculture and forestry

Intended Learning Outcomes:
To get familiar with the ecological processes that are fundamental to biological control, to get to know the biological and ecological diversity of natural enemies.To understand why fundamental research on, and knowledge of, the behavior and ecology of agriculturally relevant arthropods is

important for natural and biological control and learn how the outcome of such research may be translated into the practice of pest management.

Teaching and Learning Methods:
ppt slides, videos, vivid discussions during the lecture

Media:
Slides presented in the lecture are online accessible to students

Reading List:
Papers are issued by the lecturer

Responsible for Module:
Peter Schausberger (peter.schausberger@gmx.at)

Courses (Type of course, Weekly hours per semester), Instructor:
VO, Ecological Basis of Biological Control, 2SWS
Peter Schausberger (peter.schausberger@gmx.at)
Gernot Hoch (gernot.hoch@bfw.gv.at)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9375BOK: Ecological Plant Protection | Ecological Plant Protection

Version of module description: Gültig ab summerterm 2015

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

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

Description of Examination Method:
Regular and active participation in the course is recommended. There will be continuous oral assessment (15 %) and a written examination (85 %) at the end of the semester. In the written examination students need to demonstrate understanding of the underlying principles in biological, behavioural and physical control, and mechanisms of microbial antagonists against phytopathogens. They will have to answer questions on host resistance of plants against pests and diseases. The students will need to show their knowledge on practical applications of those principles and mechanisms.

Repeat Examination:

(Recommended) Prerequisites:
Basic knowledge on diagnosis and biology of arthropod pests and plant diseases, i.e. entomology and phytopathology, microbiology and chemistry.

Content:
Basic principles of arthropod-plant interactions; Principles in ecological plant protection; Basics in biological and microbial control and of environmental risks; Advantages and disadvantages in classical biological control, neo-classical biological control, conservation biological control, augmentative releases, inoculation and mass application methods; Successful examples in biological control of plant pests and diseases; Host resistance of plants against pests and diseases: principles and applications; Underlying mechanisms and practical applications of microbial antagonists against phytopathogens; Behavioural control of arthropod pests: theory, current and future applications; Physical pest control measurements;
Managing crop pests and diseases through cultural practices.

Intended Learning Outcomes:
Upon completion of this course, the students will be able to:
• Explain basic principles of arthropod-plant interactions and ecological plant protection.
• Assess biological and microbial control measures and their potential environmental risks.
• Name the advantages and disadvantages in classical biological control, neo-classical biological control, conservation biological control; augmentative releases, inoculation and mass application methods.
• Give successful examples in biological control of plant pests and diseases.
• Understand principles and applications of host resistance of plants against pests and diseases.
• Explain underlying mechanisms and practical applications of microbial antagonists against phytopathogens.
• Apply behavioural control measures against arthropod pests.
• Apply physical pest control measurements.
• Manage crop pests and diseases through cultural practices.

Teaching and Learning Methods:
Lecture, presentation of the lecture contents on slides using PowerPoint, practical, demonstrations

Media:
Lecture, presentation of the lecture contents on slides using PowerPoint, practical (use of microscopes, basic laboratory methods), demonstration

Reading List:

Responsible for Module:
()

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung mit Übung, Ecological Plant Protection, 2SWS
Elisabeth Koschier (elisabeth.koschier@boku.ac.at)
Rudolf Wegensteiner (rudolf.wegensteiner@boku.ac.at)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9583BOK: Exercises in Molecular Biology | Exercises in Molecular Biology

Version of module description: Gültig ab winterterm 2019/20

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

WZ9595BOK: Ethics in Organic Agriculture | Ethics in Organic Agriculture

Version of module description: Gültig ab 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

WZ9353BOK: Floriculture | Floriculture

Version of module description: Gültig ab summerterm 2015

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

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

Description of Examination Method:
continous assessment, oral presentation(seminar part) and written exam (lecture part). Obligatory presence of students in seminar units.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Taxonomy of floricultural crops. Knowledge in ecological plant physiology. Basic knowledge in floricultural crop-production.

Content:
Lecturer's presentations (floricultural crops). Review and discuss and present on plant-physiological topics of relevance for floriculture. Introduction on floricultural supply chains and quality issues. Students choose a floricultural topic, review publications and prepare a presentation and a hand-out respecting authors' guidelines (Acta Hort.). Presentations and handouts will be provided in the e-learning platform of the course.
Critical discussion and evaluation of the presentation.review of floricultural research publications - concluding presentation.

Intended Learning Outcomes:
Recognize and analyse critical points in floricultural production and supply chains. Acquire informations and develop (innovative) reasonable solutions on basis of horticultural plant physiology. Understand and apply postharvest physiology and technology in floriculture.

Teaching and Learning Methods:
Lectures. Critical review discussion (group work). Analysing contents of scientific journal articles (individual). Presenting and defending (individual and group work).

Media:
Powerpoint presentations. Videos. Greenhouse visit. E-learning. Blackboard.

Reading List:
J.M. Dole "Floriculture. Principles and Species" 2nd ed. W. Horn, 1996, "Zierpflanzenbau". Taiz, Lincon, 2010, "Plant physiology". R. Larson, 1992, Introduction to Floriculture. Acta Horticulturae (series).

Responsible for Module:
Johannes Balas (johannes.balas@boku.ac.at)

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

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

Module Description

WZ9594BOK: Field Trip - Viticulture and Oenology | Field Trip - Viticulture and Oenology

Version of module description: Gültig ab winterterm 2019/20

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

WZ9370BOK: Genetic Control of Secondary Metabolites in Perennial Crop Plants | Genetic Control of Secondary Metabolites in Perennial Crop Plants

Version of module description: Gültig ab summerterm 2015

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

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

Description of Examination Method:
Students can actively contribute to the course contents by selecting one of the topics proposed by the lecturer to be prepared and presented within the class. This would contribute 25% to the exam. There will be a written exam at the end of the semester. This exam will cover the main learning outcomes of the lecture. Students will need to show their knowledge about the different groups of secondary metabolites in plants and about their different functions as discussed during the classes.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Basic knowledge in Biochemistry

Content:
The lecture gives insights into primary and secondary metabolites in plants, with the focus on fruit crops (Pomology and Viticulture). Selected primary production processes important for fruit crops (like photosynthesis, sugar translocation, phytohormons) will be discussed at the beginning. The major part of the lecture will be on secondary metabolites, including their function within plants, the genes involved in biosynthesis and metabolism and their regulation. Different classes of secondary metabolites will be discussed in detail with selected examples of fruit crops. The influence of stress situations (biotic, abiotic, management) during the production process as well as their effects on fruit quality will be highlighted.
- Introduction and basic knowledge of genetic
- Photosynthesis and Primary Metabolites
- Introduction and Function of Secondary Metabolites

- Biosynthesis and Function of Terpenes
- Biosynthesis and Function of Cyanogenic Glycosides
- Biosynthesis and Function of Glucosinolates
- Biosynthesis and Function of Alkaloids
- Biosynthesis and Function of Polyphenols
- Engineering of metabolites and pharmaceuticals

Intended Learning Outcomes:
• Students gain knowledge about primary metabolism of fruit crops
• Students gain knowledge about the biosynthesis and function of the main groups of secondary metabolites in plants
• Students understand and can analyze the roles of secondary metabolites in plant defense
• Students understand the difference between induced resistance and systemic acquired resistance and the plant signals involved
• Students can analyze the effects of biotic and abiotic stresses on selected topics of the secondary metabolism

Teaching and Learning Methods:
Presentations and discussions within the class and further reading of scientific publications

Media:
Presentation, scientific papers

Reading List:
presentation handouts, scientific papers

Responsible for Module:
Michaela Griesser (michaela.griesser@boku.ac.at)

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture, Genetic control of secondary metabolites in perennial crop plants, 2SWS
Michaela Griesser (michaela.griesser@boku.ac.at)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9582BOK: International Agriculture | International Agriculture

Version of module description: Gültig ab winterterm 2019/20

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

WZ9592BOK: Humus | Humus

Version of module description: Gültig ab winterterm 2019/20

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

WZ9178BOK: Medicinal and Aromatic Plants | Medicinal and Aromatic Plants

Version of module description: Gültig ab winterterm 2017/18

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
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:
oral
Verbal examination

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
no

Content:
After informing on definitions, main cultivation areas and economic aspects the specific tasks of medicinal and aromatic plants (MAP) production will be discussed. Special regard will be paid to quality and quality management including the respective factors: genetics and breeding, morpho- and ontogenetic as well as environmental variability, influences by cultivation practices, harvest and post harvest technology. Guidelines for Good Agricultural Practice in MAP production and domestication of wild plants are further focal points. The most important species will be discussed in detail.

Intended Learning Outcomes:
MAPs (medicinal and aromatic plants) are typical specialist minor crops with increasing importance. The aim of the subject is to import knowledge on the diversity of this group of useful plants including their secondary products and their significance as renewable natural resources. Furthermore the frame conditions of MAP production should get known as also the most important species and their specific requirements.

Teaching and Learning Methods:
Examination dates based on personal arrangements.
The topic of the essay will be mutually agreed. The content of the essay will be verbally discussed.

Media:

Reading List:

Responsible for Module:

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

Vorlesung (3 ECTS)
Medicinal and aromatic plants (in Eng.); (LV-Nr. 951316)
2 SWS
Johannes Novak
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9373BOK: Organic Fruit Growing and Viticulture | Organic Fruit Growing and Viticulture

Version of module description: Gültig ab summerterm 2015

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

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

Description of Examination Method:
A poster has to be prepared and presented by a small group (2-4 students) on a topic of research in organic fruit production or viticulure

Repeat Examination:

(Recommended) Prerequisites:

Content:
Presentation and discussion of current research projects in different fieldsof organic fruit growing and viticulture (e.g. soil management, plant health, cultivation techniques).

Intended Learning Outcomes:
Learning methods, how to do research work in organic fruit growing and viticulture in a specific topic
Learning of skills how to prepare a poster and an oral presentation
Presentation (written and oral) of a scientific approach to a selected issue by students

Teaching and Learning Methods:
The modul starts with lectures and an excursion to give an input how research in the field of organic fruit production and viticulture works on the basis of practical examples. Ongoing and concluded work in the field is presented by researchers. In the seminar part the students work in small groups (2-4 students per group) choose topics in the field which are elaborated and presented to all students as posters.

Media:

Reading List:

Responsible for Module:
Andreas Spornberger (andreas.spornberger@boku.ac.at)

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung, Organic Fruit Growing and Viticulture, 2SWS
Andreas Spornberger (andreas.spornberger@boku.ac.at)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9374BOK: Organic Production of Vegetables and Ornamentals | Organic Production of Vegetables and Ornamentals

Version of module description: Gültig ab summerterm 2015

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

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

Description of Examination Method:
Presence of students is recommended (continous assessment), two poster presentations (draft and final poster) and a concluding written exam (lectures). Occasionally active work in working groups.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Basic knowledge of organic production systems. General knowledge of production, use and relevance of major vegetable and ornamental crops. This course is thought to be on intermediate level.

Content:
Lecturers' presentations (organic cropping, food safety and crop quality aspects, production strategies in organic horticulture). Review and discussisons on basis of journal articles of relevance for organics. Introduction on certification, organic supply chains and quality aspects. Students suggest a topic, review publications and prepare a poster and a hand-out respecting authors' guidelines (Acta Hort.). Presentations and handouts will be provided in the e-learning platform of the course.
Critical discussion and evaluation of the presentation.review of floricultural research publications - concluding presentation. Poster topics are focussed on an emphasized topic announced in the first unit.

Intended Learning Outcomes:
Understand and reproduce production techniques and main crops in organic horticulture. Recognize and analyse critical points in production and supply chains. Acquire informations and

develop (innovative) reasonable solutions on basis of scientific literature. Reflect on innovative potentials and future prospects in organic horticulture.

Teaching and Learning Methods:
Lectures. Critical review discussion (group work). Analysing contents of scientific journal articles (individual). Presentation and defensio of a scientific poster (individual and group work).

Media:
Powerpoint presentations. Videos. Greenhouse visit. E-learning. Blackboard.

Reading List:
Reddy P. Parvatha, 2010, Organic farming for horticulture. Compendia of Acta Horticulturae 767 (2008), 933 (2012) 1041 (2013)- Eckhard George, Reyhaneh Eghbal, 2009, "Ökologischer Gemüsebau".

Responsible for Module:
Johannes Balas (johannes.balas@boku.ac.at)

Courses (Type of course, Weekly hours per semester), Instructor:
Organic production of vegetables and ornamentals
Organic production of vegetables and ornamentals
Christian Vogl (null)
Heinrich Grausgruber (null)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9369BOK: Physiology and Management of the Grapevines | Physiology and Management of the Grapevines

Version of module description: Gültig ab summerterm 2015

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 3	**Total Hours:** 75	**Self-study Hours:** 45	**Contact Hours:** 30

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

Description of Examination Method:
oral and seminar presentation

Repeat Examination:

(Recommended) Prerequisites:
Solid knowledge in plant sciences, soil sciences and biology. Student must have taken Viticulture.

Content:
t
Contents:
- Fundamental principles of biology and cultivation of the grapevine including taxonomy, morphology, physiology, propagation and production as well as botanical aspects including anatomy, physiology and biochemistry of grape berry development and fruit ripening.
- Impact of physiological variables such as photosynthesis, assimilate translocation, mineral nutrition, phytohormones and water relations on growth and fruit development, ripening and composition.
- Stress physiology; Impact of abiotic and biotic stresses, plant stress symptoms, reaction pathways, genetic mutations, etc. Special discussion of stress physiology on selected issues, based on current research.

Intended Learning Outcomes:
Studens will be provided with a detailed understanding of grapevine physiology and management of vines for quality and wine production. Students successfully finishing this class will:
Deep insight on the the biology of the grapevine (anatomy, morphology development and reproduction,

understand the processes of fruit set, berry ripening and factors affector the ripining process on the vine,
Understand the impact of physiological vairables (e.g. photosynthesis, water relation and assimilate translocation on growth and fruit development, ripening and composition
Learn the physiological impact of stress on the vine

Teaching and Learning Methods:
Interaktion Lehrende und Lernende
Teaching and Learning method:
- Lectures combined with presentations of current selected research projects and in class discussion
- Repetitorium
- Practises

Media:
presentation, lecture, PowerPoint, scriptum

Reading List:
scriptum, actual articles from scientific journals will be provided;

Responsible for Module:
Astrid Forneck (astrid.forneck@boku.ac.at)

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

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

Module Description

WZ9376BOK: Plant Nematology | Plant Nematology

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 1.5	**Total Hours:** 45	**Self-study Hours:** 30	**Contact Hours:** 15

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

Description of Examination Method:
Regular and active participation in the entire course is strongly recommended. The written multi-choice test (60 min) takes place at the end of semester and student will demonstrate their knowledge in plant nematology. Text comprises question from both the lecture and practical parts. The questions are very diverse: students have to choose and mark right answers, answer the question with few sentences or to recognize what is depicted on the pictures.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Basic biology and agriculture

Content:
"Nematodes are important members of many ecosystems at different levels in the trophic hierarchy. The focus of this course is set on the biology of plant parasitic nematodes, their economic relevance and their control. Students are introduced into nematode structural and functional anatomy, strategies of plant parasitism, the interaction with the host plant, and nematode virus transmission. Examples are presented to show the importance of nematodes in different agrosystems and to give insights in the general principles of nematodes control. Problems of applied plant nematology are discussed and related to the current basic research in these fields."

Intended Learning Outcomes:
Basic knowledge in the plant nematology will be learned as well as the biology of selected plant pathogenic nematodes and their control

Teaching and Learning Methods:
Lecture is supported by powerpoint slides, movies and short practical parts enabling the students to get hands on different fresh materials such as plant infected with nematodes, sterile nematode cultures etc. In extended pratical part soil organisms will be extracted from the soil and examine microscopically.

Media:
powerpoint presentation (slides of each lecture available at BOKUonline), movies

Reading List:
Plant Nematology, Perry R.N. & Moens M. (eds). 2013.Second edition. Wallingford, Oxfordshire, UK and Boston, USA, CABI Publishing, 536 pp.

Responsible for Module:
Krzysztof Wieczorek krzysztof.wieczorek@boku.ac.at

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Plant Nematology
2 SWS
Krzysztof Wieczorek
Boku
krzysztof.wieczorek@boku.ac.at
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9581BOK: Physiological Disorders of Grapevine | Physiological Disorders of Grapevine

Version of module description: Gültig ab winterterm 2019/20

Module Level:	Language:	Duration:	Frequency:
Credits:* 1.5	**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

WZ9584BOK: Plant Biochemistry and Cell Biology | Plant Biochemistry and Cell Biology

Version of module description: Gültig ab winterterm 2019/20

Module Level:	Language:	Duration:	Frequency:
Credits:* 2.5	**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

WZ9347BOK: Rhizosphere Processes and their Application for Agriculture and Soil-protection | Rhizosphere Processes and their Application for Agriculture and Soil-protection

Version of module description: Gültig ab summerterm 2015

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

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

Description of Examination Method:
Written exam (multiple choice) of 45 minutes duration. The exam consists of 10 questions of equal weight (5 points each), wich gives a maximum of 20 total points. The minimum required to pass the exam is 12 points (60%). Sample questions are available online (see "examination examples")

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge in soil and plant sciences (at least bachelor level).

Content:
The module consits of a lecture (3 ECTS) and combines fundmental information about the rhizosphere with applications in agriculture, soil protection and environmental technology. The lecture is structured in 7 main chapters as detailed below:
- Defnition of the rhizosphere
- Extension and characteristics of the rhizosphere-
- Physical and chemical processes in the rhizosphere
- Biological processes in the rhizosphere
- Methods of rhizosphere research
- Application to sustaiable agriculture (rhizotechnologies)
- Applications to environmental technologies, soil protection and remediation (rhizotechnologies)

Intended Learning Outcomes:
Aims: Know about and understand fundamental processes in the rhizosphere and their applications in environmental technology and sustainable agriculture

Objectives:
- Know about concepts of root systems and the rhizosphere
- Know about and understand fundamental physical, chemical and biological processes in the rhizosphere and their interaction
- Appreciate the importance of rhizosphere processes in plant nutrition, pollutant uptake and ecotoxicology
- Know about possible applications of the rhizosphere (rhizosphere management) in environmental technology and sustainable agriculture

Teaching and Learning Methods:
Lecturing supported by power point presentation and interactive discussions

Media:
Presentations (=Skript) and lists with possible questions

Reading List:
Uren, N.C. 2007. Types, amounts, and possible functions of compounds released into the rhizosphere by soil-grown plants. In:Pinton, R., Varini, Z., Nannipieri, P. (eds.) 2001. The rhizosphere. biogeochemistry and organic substances at the soil-plant interface. CRC Press, Boca Raton. Waisel Y, Eshel A, Kafkafi U, eds. 2002. Plant roots - the hidden hald. New York, Basel: Marcel Dekker Inc, 1136 pp.- Hinsinger P., Gobran G.R., Gregory P.J., Wenzel W.W. 2005: Rhizosphere geometry and heterogeneity arising from root-mediated physical and chemical processes. New Phytologist, 168, 2, 293-303.
- Marschner, H. 1995: Mineral nutrition of higher plants. Second Edition, Academic Press, Boston.
- Waisel, Y., Eshel, A., Kafkafi, U. (eds.) 2002: Plant roots. The hidden half. Third Edition, Marcel Dekker, New York.
- Gobran, G.R., Wenzel, W.W., Lombi, E. (eds.) 2001: Trace elements in the rhizosphere.CRC Press, Boca Raton.
- Huang, P.M., Gobran G.R. (eds) 2005: Biogeochemistry of trace elements in the rhizosphere. Elsevier, Amsterdam.
- Pinton, R., Varini, Z., Nannipieri, P. (eds.) 2001: The rhizosphere. Biogeochemistry and organic substances at the soil-plant interface. Marcel Dekker, New York.

Responsible for Module:
Walter Wenzel (walter.wenzel@boku.ac.at)

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung, Rhizosphere Processes and Application to Agriculture and Soil Protection, 2SWS
Walter Wenzel (walter.wenzel@boku.ac.at)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9207BOK: Special Vegetable-Growing | Special Vegetable-Growing

Version of module description: Gültig ab summerterm 2015

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

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

Description of Examination Method:
Regular and active participation in the course is strongly recommended. During the whole course the students are strongly encourage to discuss the presented subjects as well as to extend the contents of the areas of special interest. At the end of the lectures the written examination as open questions will be performed. This form allows the deep description of predefined subject as well as to present the production possibilities or cultivation technics on the logically way and in the form of graphs.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Basic knowlege of botany, plant physiology, soil science, plant production, and environmental chemistry.

Content:
Biology, description, utilization possibilities, and growning methods of different vegetable species. Use of genetic variability depends on the kind of culture technique, growth and quality requirements. Analyses of culture and plant development , propagation methods, fertlization, irrigation, crop rotation, most important pests and diseases in cultivation of different vegetable species. Plant care technics and special treatments used in vegetable cultivation. Different harvesting mehods, postharvest handling and marketing of vegetable crops.

Intended Learning Outcomes:
After the successfull completion of the course the students will know the heredity of vegetables, can list and classify the groups, species and basic varieties of vegetables. They can apply the varieties for different cultivation methods (e.g. conventionally and organic, field and green house). Furthermore, they are able to define the agrotechnically date and cultivation methods in field and

greenhouse production. They evaluate the influence of environmental factors on vegetable growth and quality and may manage them, can plan and organize the production process from use of species and cvs to postharvest handling.

Teaching and Learning Methods:
Multimedia presentations, films, discussion of presented subjects and actual development, scriptum, description of chosen examples, interactive solutions of problems in vegetable production, questioning and permanent evaluation of understanding of presented information

Media:
Multimedia presentations, films, discussions, scriptum, blackboard explanations and paintings

Reading List:
Lecture scriptum, Vogel, G. u. a. (1996): Handbuch des speziellen Gemüsebaues, Ulmer Verlag, 1127 S.; Krug, H., Liebig, H.-P. & Stützel, H. (2002): Gemüseproduktion, Ulmer Verlag, 463 S.; Eckhard, G. & Eghbal R. (2009): Ökologischer Gemüsebau, Bioland Verlags, 368 S.; Wonneberger, C. & Keller, F. (2004): Gemüsebau, Ulmer Verlag, 384 S.;
Jansen, H. u. a. (1998): Gärtnerischer Pflanzenbau, Ulmer Verlag, 447 S.

Responsible for Module:
Anna J. Keutgen (anna.keutgen@boku.ac.at)

Courses (Type of course, Weekly hours per semester), Instructor:
Vorlesung, Special Vegetable-Growing, 2SWS
Anna J. Keutgen (anna.keutgen@boku.ac.at)
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9593BOK: Soil - Plant Science Workshop: From the Hypothesis to Publication II | Soil - Plant Science Workshop: From the Hypothesis to Publication II

Version of module description: Gültig ab winterterm 2019/20

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

WZ9596BOK: System Analysis and Scenario Technique - Methods and Practices | System Analysis and Scenario Technique - Methods and Practices

Version of module description: Gültig ab summerterm 2020

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

WZ9371BOK: Viticulture and Pomology Journal Club | Viticulture and Pomology Journal Club

Version of module description: Gültig ab summerterm 2015

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 3	**Total Hours:** 75	**Self-study Hours:** 50	**Contact Hours:** 25

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

Description of Examination Method:
oral and written

Repeat Examination:

(Recommended) Prerequisites:
Solid knowledge of viticulture and or fruit sciences to understand and interpret newly published publications in the field. Very good knowledge in English.

Content:
All students (Master, phd) are invited to participate in a group discussion.

The goals are to improve your understanding of scientific methods by analysing experimental work. You may learn to interprete results and critically discuss them.

Ultimately you greatly expand your vision and tools writing your own paper!

Intended Learning Outcomes:
Students participating in the class will learn to:
+approach scientifc publications by getting experience reading a paper,
+get insight into the process of publishing a scientific paper,
+get acquainted with scientific topics related to viticulture and pomoloy
+improve understanding of scientific methods by analyzing experimental work and interprete results and critically discuss them in group work
+May learn how to compose a scientific paper by reviewing examples.

Teaching and Learning Methods:
Students are required to prepare selected scientific publications prior to class according to a syllabus introduced in the first lecture.

Media:
presentation, lecture, PowerPoint, scriptum

Reading List:
scriptum, actual articles from scientific journals will be provided;

Responsible for Module:
Astrid Forneck (astrid.forneck@boku.ac.at)

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

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

Module Description

WZ9413BOK: World Wines and Viticulture | World Wines and Viticulture

Version of module description: Gültig ab summerterm 2015

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 3	**Total Hours:** 75	**Self-study Hours:** 45	**Contact Hours:** 30

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

Description of Examination Method:
Regular and active participation in the course is strongly recommended. There will be an written examination (70 %) and a written essay (30 %) at the end of semester. The learning outcome is tested and the students will need to show an understanding of the topics.

Repeat Examination:

(Recommended) Prerequisites:
Knowledge of botany, viticulutre, terroir, wine sensory at bachelor level would be desirable

Content:
Each unit will display a country and its, terroir, climate, wines. Lecture starts with an introduction and closes with a wine tasting with wines of the country.
Each unit will display a country and its, terroir, climate, wines. Lecture starts with an introduction and closes with a wine tasting with wines of the country.

Intended Learning Outcomes:
The student gain insights into international terroirs (Europe, new world) employing examples by which the students learn
- to link geography and climate with wine style;
- to evaluate effects of political structures and strategies of marketing on winemaking;
- to get proof through wine tastings
- to discuss the above mentioned topics

Teaching and Learning Methods:
Lectures, wine senory training, discussions, essay

Media:
Power Point Folien, eLearning

Reading List:

Responsible for Module:
Ulrike Anhalt (ulrike.anhalt@boku.ac.at)

Courses (Type of course, Weekly hours per semester), Instructor:
Seminar, World Wines and Viticulture, 2SWS
Ulrike Anhalt
For further information in this module, please click campus.tum.de or here.

Humboldt University Berlin | Humboldt-Universität Berlin

Module Description

WZ9276HU: Methods of Monitoring and Evaluation of Technical Processes in Horticulture | Methods of Monitoring and Evaluation of Technical Processes in Horticulture

Version of module description: Gültig ab winterterm 2012/13

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

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

Description of Examination Method:
Reports, oral examination

Repeat Examination:

(Recommended) Prerequisites:
B.Sc.

Content:
Analysis of pipeline systems, figure of merit in refrigeration technology, soil characteristics at building site, surveying and mapping, check-up of measuring systems, phytomonitoring, greenhouse processing, greenhouse automation, phytocontrol technology, quality of irrigation systems, planning and control of artificial light systems, methods for evaluation of climate condition and climate control in production and post-harvest processes

Intended Learning Outcomes:

Teaching and Learning Methods:
Seminars, class experiments, problem solving activities

Media:

Reading List:
N/A

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

WZ9301HU: Advanced Plant Pathology | Advanced Plant Pathology

Version of module description: Gültig ab summerterm 2015

Module Level: Master	Language: English	Duration: one semester	Frequency: winter semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 125	**Contact Hours:** 55

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

Description of Examination Method:
Written exam, 90 minutes (1/3), Lab-paper, ca.
15,000 characters (1/3)and Presentation of lab-paper, 15 minutes (1/3).
In the written examination, students demonstrate by answering questions under time pressure and without helping material the theoretical knowledge about advanced entomology.
Plant pathogens in the environment. Epidemiology and diagnosis of plant pathogens in particular introduction of quarantine pests and invasive species. Critical discussion of plant protection strategies. Evaluation and assessment of measures and management tools. Identification and evaluation of phytosanitary risks including the analysis of, for example the commodity flow, identity of the organisms, their potential for establishing and spreading, of possible economic impact as well as ecological consequences.

Repeat Examination:

(Recommended) Prerequisites:
BSc

Content:
Lecture:
• isolation and purification of specific patho- gens
• pathogenicity of pathogens
• relevance of investigated pathogens
• evaluation of diagnosis methods
Lab course and seminar: Further discussion of lecture topics

Intended Learning Outcomes:
The students
• have a clear understanding of isolation and purification of specific pathogens,
• assess the pathogenicity of pathogens,
• are able to apply specific methods using different kind of samples,
• reflect the relevance of the investigated pathogens in agriculture and horticulture as well as the quality rating of the applied methods and
• are capable to evaluate the results of diverse methods applied in diagnosis.

Teaching and Learning Methods:
Lecture, presentation, Experiment

Media:
Presentation slides, articles, student presentations, exercise sheets

Reading List:
Script and Excercise sheets

Responsible for Module:
Carmen Büttner carmen.buettner@agrar.hu-berlin.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Advanced Plant Pathology
2 SWS

Lab practical
Advanced Plant Pathology
1 SWS

Seminar
Advanced Plant Pathology
1 SWS
Carmen Büttner
HU Berlin
carmen.buettner@agrar.hu-berlin.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9288HU: Biology of Generative Propagation in Horticulture | Biology of Generative Propagation in Horticulture

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 130	**Contact Hours:** 50

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

Description of Examination Method:
Reports, oral examination

Repeat Examination:

(Recommended) Prerequisites:
B.Sc.

Content:
• seed production, effect of environmental factors on seed quality
• physiology of fertilisation and germination
• regulation of germination
• methods of seed quality evaluation
• storage of orthodox and recalcitrant seeds
• effect of seed quality on growth and yield
• certification of origin

Intended Learning Outcomes:
After sucessfully passing the modules, the students
- know about biology of pollination, fertilization and embryogenesis
- know the criteria of seed quality
- are able to apply methods to investigate seeds quality
- have a clear understanding of factors affecting the seed quality

Teaching and Learning Methods:
Seminars, class experiments, round tables, problem solving activities

Media:
Power Point, Scripts, Excercise sheets

Reading List:
N/A

Responsible for Module:
Ina Pinker ina.pinker@agrar.hu-berlin.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Biology of Generative Propagation in Horticulture
3 SWS

Lab course
Biology of Generative Propagation in Horticulture
1 SWS

Ina Pinker
HU Berlin
ina.pinker@agrar.hu-berlin.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9280HU: Crop Quality Assessment | Crop Quality Assessment

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 130	**Contact Hours:** 50

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

Description of Examination Method:
Exam duration (in min.): 15 plus 90.
The examination consists of a presentation of the gained deeper knowledge of the quality determination methods in a 15 minute oral report of the lab report (ca. 12.000 characters) (50%) and a written examination (90 min)(50%). In the written examination, students demonstrate by answering questions under time pressure and without helping material the theoretical knowledge about quality determination methods.
Topics of the exam: Theory of methods for quality evaluation and determination of food crops incl. critical evaluation of nutritional and food safety relates issues, destructive and non-destructive methods (biochemical, physical, instrumental) for quality determination and quality control

Repeat Examination:

(Recommended) Prerequisites:
B.Sc.

Content:
- Methods for quality evaluation and determination of horticultural crops
- Destructive and non-destructive methods being applied during production, postharvest operations and distribution
- Application of common biochemical, physical and instrumental methods for quality determination including food nutritional and food safety relates issues

Intended Learning Outcomes:
At the end of the module the students
- have a clear understanding and know-how of the methods for quality evaluation and determination of horticultural crops

- have a fundamental know-how of destructive and non-destructive methods being applied during production, postharvest operations and distribution
- have the capability to apply common biochemical, physical and instrumental methods for quality determination including food nutritional and food safety relates issues

Teaching and Learning Methods:
Lecture, Lab course

Media:

Reading List:
N/A

Responsible for Module:
Susanne Huyskens-Keil susanne.huyskens@agrar.hu-berlin.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Crop Quality Assessment
2 SWS

Lab course
Crop Quality Assessment
2 SWS
Susanne Huyskens-Keil
HU Berlin
susanne.huyskens@agrar.hu-berlin.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9286HU: Development of New Floricultural Products | Development of New Floricultural Products

Version of module description: Gültig ab summerterm 2013

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

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

Description of Examination Method:
The examination consists of a presentation of the gained deeper knowledge of new floricultural products in a 15 minute oral report with following discussion (66 %), and a oral examination (33 %). In the oral examination (30 min), students demonstrate by answering questions their theoretical knowledge about structures and problems of the development of new floricultural products, new trends and have to know an assortment of important new plants, evaluation of the assortment

Repeat Examination:

(Recommended) Prerequisites:
Preconditions for participation: none, recommended: basic knowledge in statistics

Content:
- Up-to-date national and international trends and methods to develop new floricultural products
- Diversification and evaluation of the assortments
- Specific development of selected groups of flowers and model products

Intended Learning Outcomes:
At the end of the module, the Students
- have a clear understanding of structures and problems of the development of new floricultural products
- have the capability to formulate solutions for development trends
- are able to answer questions of the international development of new floricultural products

Teaching and Learning Methods:
Seminars, class experiments, presentation, problem solving activities

Media:
Power point, exercise sheets, script

Reading List:
N/A

Responsible for Module:
Heiner Grüneberg hgrueneberg@agrar.hu-berlin.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Development of New Floricultural Products
3 SWS

Seminar
Development of New Floricultural Products
1 SWS
Heiner Grüneberg
HU Berlin
hgrueneberg@agrar.hu-berlin.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9284HU: Ecophysiological Basics of Urban Horticulture | Ecophysiological Basics of Urban Horticulture

Version of module description: Gültig ab summerterm 2013

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

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

Description of Examination Method:
Written exam, 90 minutes (50 %), Written assignment ca. 15,000 characters and the presentation of the assignment 15 minutes (50%).
In the written examination, students demonstrate by answering questions under time pressure and without helping material the theoretical knowledge about effects of urban stressors for plant quality.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
B.Sc.

Content:
- Physiological and ecological bases of plant performance in urban landscapes
- Ecology of interaction between native and introduced plant species
- Protection against plant pests and pathogens in urban contexts
- Urban Stressors and their impact on plant health

Intended Learning Outcomes:
After completion of the module the students
- have a clear understanding of effects of urban stressors for plant quality
- are able to categorize urban stress factors
- and know the possibilities to quantify stress factors

Teaching and Learning Methods:
Seminars, class experiments, problem solving activities

Media:
Presentation slides, student presentations

Reading List:
N/A

Responsible for Module:
Christian Ulrichs christian.ulrichs@agrar.hu-berlin.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Ecophysiological Basics of Urban Horticulture
2 SWS

Seminar
Ecophysiological Basics of Urban Horticulture
2 SWS
Christian Ulrichs
HU Berlin
christian.ulrichs@agrar.hu-berlin.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9293HU: Effects of Plant Nutrition and other Environmental Factors on Composition and Quality of Vegetable and Ornamental Plants | Effects of Plant Nutrition and other Environmental Factors on Composition and Quality of Vegetable and Ornamental Plants

Version of module description: Gültig ab winterterm 2013/14

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 130	**Contact Hours:** 50

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

Description of Examination Method:
In the written examination (30 min), students demonstrate by answering questions under time pressure and without helping material the theoretical knowledge about functions of mineral elements in the primary and secondary metabolism of plants and effects of plant nutrition and other environmental factors on plant composition, taste, and quality

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
BSc.

Content:
- Functions of mineral elements in the primary and secondary metabolism of plants
- Effects of plant nutrition and other environmental factors on plant composition, taste, and quality"
Practical application of methods

Intended Learning Outcomes:
After the aktive participation in this module, students
- have a clear understanding of the plant physiological role of mineral elements,
- have a clear understanding of the effect of environmental factors on plant composition and quality and

- are able to design new horticultural systems with the potential to grow high-quality horticultural products."

Teaching and Learning Methods:

Media:
PP presentation, Descriptions of Experiments

Reading List:
Handouts and selected paper will be given to the students during the lecture by the lecturer.

Responsible for Module:
Eckhardt George george@igzev.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Effects of Plant Nutrition and ...
2 SWS

Lab Practical
Effects of Plant Nutrition and ...
2 SWS
Eckhardt George
HU Berlin
george@igzev.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9285HU: Environmental Management and Information Systems | Environmental Management and Information Systems

Version of module description: Gültig ab summerterm 2013

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

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

Description of Examination Method:
The examination consists of an oral group exam (group of 4) 20 min per student (50 %), based on the seminar paper (ca. 45,000 characters per group of 4) (50 %) presentation of the gained deeper knowledge of environmental management and information systems.

Repeat Examination:

(Recommended) Prerequisites:
B.Sc.

Content:
- Introduction:
o Motives for the introduction of QM/EM
o Approaches (system approach, stakeholder concept)
o Basic ethical positions
- Options of politics, authorities and enterprises
o Legal restrictions; market mechanisms, negotiation solutions
o Integrated Management Systems
- Information and Assessment Systems
o Data base
o Methods, Modelling
o Approaches for assessment and related problems
- Environmental marketing; environmental and risk communication
- Sustainable Value Chains and CSR

Intended Learning Outcomes:
The students
- are able to identify driving forces for the introduction of QM/EM systems;
- have learned about basic concepts and theory approaches for quality-/ environmental management;
- can describe and judge basic concepts and data bases of environmental information systems;
- are familiar with principles and problems of assessment.

Teaching and Learning Methods:
Seminars, reading papers, class experiments, team work, problem solving activities,

Media:
Presentation slides, papersles and short texts,   and reviews.

Reading List:
N/A

Responsible for Module:
Wolfgang Bokelmann w.bokelmann@agrar.hu-berlin.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Environmental Management and Information Systems
3 SWS

Seminar
Environmental Management and Information Systems
1 SWS
Wolfgang Bokelmann
HU Berlin
w.bokelmann@agrar.hu-berlin.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9300HU: Farm Management in the Agricultural and Horticultural Sector | Farm Management in the Agricultural and Horticultural Sector

Version of module description: Gültig ab summerterm 2015

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 130	**Contact Hours:** 50

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

Description of Examination Method:
In the oral examination (30 minutes), students demonstrate by answering questions the theoretical knowledge about

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
BSc.

Content:
-Strategic management in agribusiness
o Theoretical approaches
o Planning

- Organization theory
o Theoretical approaches
o Design principles

- Interorganisational coordination
o Cooperation
o Chain management

- Basics of information and knowledge management"

Intended Learning Outcomes:
After participation the students are able

- to describe and to explain basic concepts and theoretical approaches of agricultural management and
- to use and to evaluate models for decision support."

Teaching and Learning Methods:
Lecture, in the seminar part further discussions of lecture topics

Media:
ppt slides, videos, vivid discussions during the lecture

Reading List:
hand-outs

Responsible for Module:
Wolfgang Bokelmann w.bokelmann@agrar.hu-berlin.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Farm Management in the Agricultural and Horti ...
2 SWS

Seminar
Farm Management in the Agricultural and Hortic....
2 SWS
Wolfgang Bokelmann
HU Berlin
w.bokelmann@agrar.hu-berlin.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9279HU: Food Chain Management | Food Chain Management

Version of module description: Gültig ab winterterm 2012/13

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

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

Description of Examination Method:
Reports, oral examination

Repeat Examination:

(Recommended) Prerequisites:
B.Sc.

Content:
Concepts of plant food supply management systems; National and international laws and orders; Evaluation of quality control systems in food supply chains from production until utilization; Quality assurance and process operations (consumer oriented aspects; physiological, nutritional and technological aspects); Quality management systems.

Intended Learning Outcomes:
The students
- have a clear understanding of plant food quality criteria, quality indicators and quality index
- have knowledge of national and international laws and orders in food chain management systems
- have knowledge and an understanding of methods of quality assurance in food chain management systems (production, processing, industrial utilization, fresh market) including critical control points and food safety
- have the capability to evaluate postharvest technological operations
- have the capability to evaluate the possibilities and problems in management of food supply chain systems

Teaching and Learning Methods:
Seminars, class experiments, problem solving activities

Media:

Reading List:
N/A

Responsible for Module:
Susanne Huyskens-Keil

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

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

Module Description

WZ9283HU: Horticultural Outdoor Plant Systems | Horticultural Outdoor Plant Systems

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 130	**Contact Hours:** 50

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

Description of Examination Method:
The examination consists of a 15 min presentation of the seminar paper (ca. 15.000 characters) (50 %) and a written examination (90 min)(50%). In the written examination, students demonstrate by answering questions under time pressure and without helping material the theoretical knowledge about urban horticultural topics.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
B.Sc.

Content:
Basics of the establishing and maintenance of plants on special urban places like roof gardens, water cleaning systems with plants/rainwater management, playing and leisure grounds, dry places, rail bed greening systems, cemeteries e.g.

- Imparting of basic knowledge of planning processes at the urban outdoor designing

Intended Learning Outcomes:
After completion the students
- have a clear understanding of meaning, structures and requirements of special urban groups of decorative plants
- are able to find solutions for special situations
- have the capability to assess schemes of improvements and situations of practical utilization.

Teaching and Learning Methods:
Seminars, class experiments, problem solving activities

Media:
Presentation slides, websites, papers and short texts, student presentations

Reading List:
selected papers handed out by the lcturer

Responsible for Module:
Cornelia Oschmann c.oschmann@agrar.hu-berlin.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Horticultural Outdoor Plant Systems
2 SWS

Seminar
Horticultural Outdoor Plant Systems
2 SWS
Cornelia Oschmann
HU Berlin
c.oschmann@agrar.hu-berlin.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9292HU: International Floriculture and Nursery | International Floriculture and Nursery

Version of module description: Gültig ab summerterm 2011

Module Level:	Language:	Duration:	Frequency:
Master	English	one semester	summer semester
Credits:*	**Total Hours:**	**Self-study Hours:**	**Contact Hours:**
6	180	130	50

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

Description of Examination Method:
The examination consists of a presentation (15 min) (1/3) about one important ornamental plant (the international impact and about the producing countries) or about one selected country (climate and geographical characteristics, production, trade, assortment, social aspects in this country and if possible about the specific education there) and an Oral examination (30 min) (2/3) about the most important countries of one selected continent: exchange of ornamental plants and nursery products, value and area production of flowers and plants, assortment of flowers and nursery products, conditions of production, trade and economic development.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
BSc.

Content:
- International production systems
- The use of main groups of flowers and nurs- ery products
- Analysis of countries and continents
- Networking and international trade with flowers and nursery products
- Ecological and social aspects of the produc- tion"

Consolidation of the lecture contents through presenting own findings about ornamentals or countries with importance for ornamentals.

Intended Learning Outcomes:
After sucessful participation, the students

- have a good knowledge of the meaning and the structures from special product groups of decorative
plants and nursery products,
- have a clear understanding on requirements of the specific use of the products,
- have the capability to evaluate the different production structures,
- are able to make inquiries about production, trade and consumption of floricultural and nursery products and
- are able to assess the ecological and social aspects of production and marketing in different countries."

Teaching and Learning Methods:
Lecture, seminar

Media:
Presentation slides, websites, papers and short texts, multi-media (podcasts, video clips), student presentations.

Reading List:
selected papers

Responsible for Module:
Heiner Grüneberg hgrueneberg@agrar.hu-berlin.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
International Floriculture and Nursery
3 SWS

Seminar
International Floriculture and Nursery
1 SWS
Heiner Grüneberg
HU Berlin
hgrueneberg@agrar.hu-berlin.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9278HU: Physiology of Woody Plants and Applied Dendrology | Physiology of Woody Plants and Applied Dendrology

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 130	**Contact Hours:** 45

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

Description of Examination Method:
In the oral examination (30 min), students demonstrate by answering questions under time pressure and without helping material their theoretical knowledge about physiology of Woody Plants (energizing processes, response and control mechanisms, Water and nutrient cycles, secondary metabolism, stress physiology, coevolution between woody plants and herbivores), Applied Dendrology (nomenclature and classification of trees, and about Special Dendrology of deciduous and coniferous trees by determination of trees und shrubs).

Repeat Examination:

(Recommended) Prerequisites:
B.Sc

Content:
- Basics of woody plant physiology
- Energy delivering processes, reaction- and control mechanisms, water- and nutrient circulations, adaptation mechanisms
- Stress physiology, concurrence, coevolution between woody plants and herbivores
- Nomenclature and systematics of woody plants, explanation of botanical-dendrological terms
- Applied dendrology of deciduous plants
- Evergreen plants and conifers, genera and the most important species
- Plant determination

Intended Learning Outcomes:
After completion the students
- understand basics of woody plant physiology,

- have acquired knowledge about energy delivering processes, reaction- and control mechanisms, water- and nutrient circulations, adaptation mechanisms,
- are able to analyse stress physiology, concurrence, coevolution between woody plants and herbivores,
- are familiar with nomenclature and systematics of woody plants, explanation of botanical-dendrological terms and
- know evergreen plants and conifers, genera and the most important species.

Teaching and Learning Methods:
Lecture, class experiments (termonation of plant parts), problem solving activities

Media:
Presentation slides, websites, papers and short texts, demonstration material (parts of plants).

Reading List:
N/A

Responsible for Module:
Matthias Zander matthias.zander@agrar.hu-berlin.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Physiology of Woody Plants and Applied Dendrology
4 SWS
Matthias Zander
HU Berlin
matthias.zander@agrar.hu-berlin.de

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

Module Description

WZ9281HU: Plant Disease and Control Management | Plant Disease and Control Management

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 130	**Contact Hours:** 50

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

Description of Examination Method:
In the written examination (90 min - 50 %), students demonstrate by answering questions their theoretical knowledge about plant dieseases and their control. In the presentaion in class (20 min - 50 %) the students demonstrate their knowledge about lab-practical methods.

Repeat Examination:

(Recommended) Prerequisites:
B.Sc.

Content:
- Differential diagnosis
- Position (advantages, disadvantages, premises) of biological, electron micro- scopical, serological and molecular biologi- cal methods
- Methods applied in routine diagnosis of plant pathogens
- Relevance of plant pathogens in agriculture and horticulture
- Control measures (chemical, biological, physical, mechanical, biotechnological and prophylactic)"

Intended Learning Outcomes:
After sucessful participation the students
- have a clear understanding of differential diagnosis,
- reflect the position (advantages, disadvantages, premises) of biological, electron microscopical, serological and molecular biological methods,
- have the capability to evaluate the results of diverse methods applied in routine diagnosis of plant pathogens,

- have a clear understanding of the relevance of plant pathogens in agriculture and horticulture,
- have the capability to evaluate control measures (chemical, biological, physical, mechanical, biotechnological and prophylactic)."

Teaching and Learning Methods:
Seminars, class experiments, problem solving activities

Media:
Presentation slides, student presentations

Reading List:
N/A

Responsible for Module:
Carmen Büttner carmen.buettner@agrar.hu-berlin.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Plant Disease and Control Management
2 SWS

Seminar
Plant Disease and Control Management
2 SWS
Carmen Büttner
HU Berlin
carmen.buettner@agrar.hu-berlin.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9277HU: Plant Nutrition in Environmental-friendly Horticultural Systems | Plant Nutrition in Environmental-friendly Horticultural Systems

Version of module description: Gültig ab summerterm 2013

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

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

Description of Examination Method:
Reports, oral examination

Repeat Examination:

(Recommended) Prerequisites:
B.Sc.

Content:
- Environmental benefits and costs of fertilization in horticultural systems
- Interactions of fertilization with plant CO2 fixation
- Low-energy horticultural production and intelligent nutrient supply systems
- Plant nutrition in biological horticultural production systems

Intended Learning Outcomes:
After completion participants
- have a clear understanding of environmental effects of fertilization and horticultural production systems and
- of mineral element cycles and energy production and consumption in horticultural systems
- are able to design new horticultural systems with low nutrient and energy requirements

Teaching and Learning Methods:
Lectures, Seminars (further discussion of lecture topics), lab practicals (for practical application of methods)

Media:
Presentation slides, lab supplies and chemicals

Reading List:
N/A

Responsible for Module:
Eckhard George george@igzev.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Plant Nutrition in Environm.-friend. Hort. Systems
2 SWS

Seminar
Plant Nutrition in Environm.-friend. Hort. Systems
1 SWS

Lab practical
Plant Nutrition in Environm.-friend. Hort. Systems
1 SWS
Eckhard George
HU Berlin
george@igzev.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9282HU: Post-harvest Quality and Stored Product Protection | Post-harvest Quality and Stored Product Protection

Version of module description: Gültig ab summerterm 2013

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 130	**Contact Hours:** 50

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

Description of Examination Method:
In the written examination (90 min), students demonstrate by answering questions under time pressure and without helping material the theoretical knowledge about quality characteristics and evaluation of agricultural and horticultural food crops, food quality and food safety related laws and orders for local and export markets, methods of quality determination, postharvest operations and storage regimes; abiotic and biotic stress factors -their evaluation and prevention; basics in stock protection (storage structures and habitats, stored-product pests, early detection of stored-product pests, monitoring, prevention strategies pest control methods).

Repeat Examination:

(Recommended) Prerequisites:
B.Sc.

Content:
Quality characteristics and evaluation of agricultural and horticultural food crops, food quality and food safety related laws and orders for local and export markets, methods of quality determination, postharvest operations and storage regimes; abiotic and biotic stress factors -their evaluation and prevention; basics in stock protection (storage structures and habitats, stored-product pests, early detection of stored-product pests, monitoring, prevention strategies pest control methods)

Intended Learning Outcomes:
After active participation, the students know
- quality characteristics and evaluation of economical important agricultural and horticultural food crops,

- food quality and food safety related laws and orders for local and export markets,
- methods of quality determination,
- postharvest operations and storage regimes,
- basics in stock protection and
- abiotic and biotic stress factors, their evaluation and prevention."

Teaching and Learning Methods:
Seminars, class experiments, problem solving activities

Media:
PP presentation, papers,

Reading List:
N/A

Responsible for Module:
Susanne Huyskens-Keil susanne.huyskens@agrar.hu-berlin.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Post-harvest Quality and Stored Product Protection
3 SWS

Seminar
Post-harvest Quality and Stored Product Protection
1 SWS
Susanne Huyskens-Keil
HU Berlin
susanne.huyskens@agrar.hu-berlin.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9291HU: Urban Horticulture: An Introduction | Urban Horticulture: An Introduction

Version of module description: Gültig ab summerterm 2015

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 135	**Contact Hours:** 45

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

Description of Examination Method:
In the written examination (90 min), students demonstrate by answering questions under time pressure and without helping material their theoretical knowledge about design and management of urban small-scale landscapes, bio- and species-diversity and human perceptions of urban vegetative environments, indoor green and sick building syndrom.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
B.Sc.

Content:
- Design and management of urban small- scale landscapes
- Bio- and species-diversity
- Human perceptions of urban vegetative environments
- Indoor green
- Sick building syndrome"

Intended Learning Outcomes:
After sucessful participation the students
- have knowledge about design and management of urban small-scale landscapes,
- know about bio- and species-diversity and
- know about human perceptions of urban vegetative environments, indoor green and sick building syndrome."

Teaching and Learning Methods:
Lecture,

Media:
Presentation slides, websites, articles and short texts, multi-media (podcasts, video clips), student presentations, and reviews.

Reading List:
selected papers

Responsible for Module:
Christian Ulrichs christian.ulrichs@agrar.hu-berlin.de

Courses (Type of course, Weekly hours per semester), Instructor:
Lecture
Urban Horticulture: An Introduction
4 SWS
Christian Ulrichs
HU Berlin
christian.ulrichs@agrar.hu-berlin.de
For further information in this module, please click campus.tum.de or here.

Module Description

WZ9305HU: Information and Communication Technology in Horticultural Science | Information and Communication Technology in Horticultural Science

Version of module description: Gültig ab summerterm 2017

Module Level:	Language:	Duration:	Frequency:
Credits:* 6	**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

WZ9306HU: Seminar Horticultural Science | Seminar Horticultural Science

Version of module description: Gültig ab winterterm 2017/18

Module Level:	**Language:**	**Duration:**	**Frequency:**
Credits:* 6	**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

WZ9310HU: Practices and Organization of Organic Farming | Practices and Organization of Organic Farming

Version of module description: Gültig ab winterterm 2019/20

Module Level:	Language:	Duration:	Frequency:
Credits:* 6	**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

WZ9311HU: Biodiversity: Assessment, Function and Evolution | Biodiversity: Assessment, Function and Evolution

Version of module description: Gültig ab winterterm 2019/20

Module Level:	Language:	Duration:	Frequency:
Credits:* 6	**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.

Requirement Proof of Proficiency in German | Nachweis Deutschkenntnisse

Module Description

SZ03031: Intensive Course German as a Foreign Language A2.1 | Blockkurs Deutsch als Fremdsprache A2.1

Version of module description: Gültig ab winterterm 2015/16

Module Level: Bachelor/Master	**Language:** German	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 4	**Total Hours:** 120	**Self-study Hours:** 60	**Contact Hours:** 60

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

Description of Examination Method:
1 final exam 90 min. (100%) - no learning aids permitted
The midterm exam is intended to monitor students' learning progress and reduce the amount of material covered in the final exam. Written exams will assess students level of acquisition of the learning outcomes specified in the module description. Specifically, exam questions focus on the usage of vocabulary and grammar, as well as reading comprehension and text production. Listening comprehension is tested by posing questions based on audio samples to which students respond in writing.
Verbal skills are evaluated using appropriate prompts from sample print dialogs.

Repeat Examination:

(Recommended) Prerequisites:
Firm knowledge of level A1.2; placement test with the achievement A2.1

Content:
In this module, students acquire basic knowledge of the German language, including intercultural and regional aspects, that will enable them to express themselves in everyday situations, such as traveling, at the doctor’s office, searching for an apartment, in a department store, among colleagues, friends or neighbors.

Students learn and practice basic vocabulary and expressions on topics such as education, profession, health and traveling. Students learn and practice using simply structured main and

subordinate clauses (that, because, and, than, etc.), employing the preterit (modal verbs) and perfect, as well as the comparative, the superlative and the declination of the adjective. They reinforce and expand the usage of the prepositions in the accusative and dative case.
Students learn strategies for successful verbal and written communication despite minimal language skills. Opportunities will be made available for effective, self-motivated, independent learning. Students acquire teamwork skills through collaborative work in multinational mixed groups.

Intended Learning Outcomes:
The module is based on level A2 of GER.
Upon completion of this module, students are able to understand and use simple sentences and expressions in conversations on a broad spectrum of familiar topics. These conversations are based on basic information concerning everyday life and subjects relevant to studying or working, including sociocultural aspects of German-speaking countries.
For example, students are able to describe themselves and other people, their living situation, state of health, leisure time activities and job situation.
Students are able to understand longer texts and letters about familiar topics that include foreseeable information and are written in simple language about everyday life or job related topics. Students are able to compose short, informative texts or notifications about basic situations in everyday life or situations related to studying.

Teaching and Learning Methods:
The module consists of a seminar covering material appropriate to desired learning outcomes and encompassing relevant listening, reading, writing and speaking exercises. These exercises may take the form of individual, partner or group work, implementing a communicative and activity-oriented approach. Students have the opportunity to deepen basic knowledge conveyed in the seminar through independent study and work, using specified (online) materials covering fundamental grammar and communication patterns of the foreign language.
Voluntary homework (preparation and follow-up work) reinforces classroom and structured learning.

Media:
Textbook; multimedia-based teaching and learning materials (black board, overheads, exercise sheets, image, film, etc.) also online

Reading List:
to be announced in the Class

Responsible for Module:

Courses (Type of course, Weekly hours per semester), Instructor:
Blockkurs Deutsch als Fremdsprache A2.1 (Seminar, 4 SWS)
Gemaljevic J, Kretschmann A, Niebisch D, Semeraro G

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

Module Description

SZ0303: German as a Foreign Language A2.1 | Deutsch als Fremdsprache A2.1

Version of module description: Gültig ab winterterm 2019/20

Module Level: Bachelor/Master	**Language:** German	**Duration:** one semester	**Frequency:** winter/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:
1 final exam 90 min. (100%) - no learning aids permitted
The midterm exam is intended to monitor students' learning progress and reduce the amount of material covered in the final exam. Written exams will assess students level of acquisition of the learning outcomes specified in the module description. Specifically, exam questions focus on the usage of vocabulary and grammar, as well as reading comprehension and text production. Listening comprehension is tested by posing questions based on audio samples to which students respond in writing.
Verbal skills are evaluated using appropriate prompts from sample print dialogs.

Repeat Examination:

(Recommended) Prerequisites:
Firm knowledge of level A1.2; placement test with the achievement A2.1

Content:
In this module, students acquire basic knowledge of the German language, including intercultural and regional aspects, that will enable them to express themselves in everyday situations, such as traveling, at the doctor’s office, searching for an apartment, in a department store, among colleagues, friends or neighbors.

Students learn and practice basic vocabulary and expressions on topics such as education, profession, health and traveling. Students learn and practice using simply structured main and subordinate clauses (that, because, and, than, etc.), employing the preterit (modal verbs) and perfect, as well as the comparative, the superlative and the declination of the adjective. They reinforce and expand the usage of the prepositions in the accusative and dative case.

Students learn strategies for successful verbal and written communication despite minimal language skills. Opportunities will be made available for effective, self-motivated, independent learning. Students acquire teamwork skills through collaborative work in multinational mixed groups.

Intended Learning Outcomes:
The module is based on level A2 of GER.
Upon completion of this module, students are able to understand and use simple sentences and expressions in conversations on a broad spectrum of familiar topics. These conversations are based on basic information concerning everyday life and subjects relevant to studying or working, including sociocultural aspects of German-speaking countries.
For example, students are able to describe themselves and other people, their living situation, state of health, leisure time activities and job situation.
Students are able to understand longer texts and letters about familiar topics that include foreseeable information and are written in simple language about everyday life or job related topics. Students are able to compose short, informative texts or notifications about basic situations in everyday life or situations related to studying.

Teaching and Learning Methods:
The module consists of a seminar covering material appropriate to desired learning outcomes and encompassing relevant listening, reading, writing and speaking exercises. These exercises may take the form of individual, partner or group work, implementing a communicative and activity-oriented approach. Students have the opportunity to deepen basic knowledge conveyed in the seminar through independent study and work, using specified (online) materials covering fundamental grammar and communication patterns of the foreign language.
Voluntary homework (preparation and follow-up work) reinforces classroom and structured learning.

Media:
Textbook; multimedia-based teaching and learning materials (black board, overheads, exercise sheets, image, film, etc.) also online

Reading List:

Responsible for Module:

Courses (Type of course, Weekly hours per semester), Instructor:
Deutsch als Fremdsprache A2.1 (Seminar, 4 SWS)
Aßmann J, Bauer G, Comparato G, Geishauser C, Gemaljevic J, Keza I, Kovacs O, Kutschker T, Nierhoff-King B, Schlüter J, Semeraro G
For further information in this module, please click campus.tum.de or here.

Module Description

SZ0304: German as a Foreign Language A2.2 | Deutsch als Fremdsprache A2.2

Version of module description: Gültig ab winterterm 2019/20

Module Level: Bachelor/Master	**Language:** German	**Duration:** one semester	**Frequency:** winter/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:
1 final exam 90 min. (100%) - no learning aids permitted
Written exams will assess students level of acquisition of the learning outcomes specified in the module description. Specifically, exam questions focus on the usage of vocabulary and grammar, as well as reading comprehension and text production. Listening comprehension is tested by posing questions based on audio samples to which students respond in writing.
Verbal skills are evaluated using appropriate prompts from sample print dialogs.

Repeat Examination:

(Recommended) Prerequisites:
Firm knowledge of level A2.1; placement test with the achievement A2.2

Content:
In this module, students acquire basic knowledge of the German language, including intercultural and regional aspects, that will enable them to express themselves in everyday situations, such as traveling, at the doctor's office, searching for an apartment, in a department store, among colleagues, friends or neighbors.
Students reinforce and augment basic vocabulary and expressions on topics such as education, profession, living and traveling. Students learn and practice classifying and using an extended spectrum of main and subordinate clauses (final clause, indirect questions, temporal subordinate clause, causal sentence). They also learn to employ the preterit (modals verbs) and perfect and will repeat and expand the usage of the prepositions and the declination of the adjective.
Students learn strategies for successful verbal and written communication despite minimal language skills. Opportunities will be made available for effective, self-motivated, independent

learning. Students acquire teamwork skills through collaborative work in multinational mixed groups.

Intended Learning Outcomes:
The module is based on level A2 of GER.
Upon completion of this module, students are able to understand and use simple sentences and expressions in conversations on a broad spectrum of familiar topics. These conversations are based on basic information concerning everyday life and subjects relevant to studying or working, including sociocultural aspects of German-speaking countries.
For example, students are able to describe themselves and other people, their living situation, state of health, leisure time activities and job situation. Students are able to communicate in various situations, for example, when searching for an apartment, traveling or on holiday, and are able to report about their experiences in simple standard language.
Students are able to understand longer texts and letters about familiar topics that include foreseeable information and are written in simple language about everyday life or job related topics. Students are able to compose short, informative texts or notifications about basic situations in everyday life or situations related to studying.

Teaching and Learning Methods:
The module consists of a seminar covering material appropriate to desired learning outcomes and encompassing relevant listening, reading, writing and speaking exercises. These exercises may take the form of individual, partner or group work, implementing a communicative and activity-oriented approach. Students have the opportunity to deepen basic knowledge conveyed in the seminar through independent study and work, using specified (online) materials covering fundamental grammar and communication patterns of the foreign language.
Voluntary homework (preparation and follow-up work) reinforces classroom and structured learning.

Media:
Textbook; multimedia-based teaching and learning materials (black board, overheads, exercise sheets, image, film, etc.) also online

Reading List:

Responsible for Module:

Courses (Type of course, Weekly hours per semester), Instructor:
Deutsch als Fremdsprache A2.2 (Seminar, 4 SWS)
Aßmann J, Bauer G, Comparato G, Feistle C, Hagner V, Hanke C, Kostial M, Reulein C, Schimmack B, Selent D, Stiebeler H, Thiessen E
For further information in this module, please click campus.tum.de or here.

Module Description

SZ0322: German as a Foreign Language A2.1 plus A2.2 | Deutsch als Fremdsprache A2.1 plus A2.2

Version of module description: Gültig ab winterterm 2019/20

Module Level:	**Language:** German	**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:
1 final exam 90 min. (100%) - no learning aids permitted
Written exams will assess students level of acquisition of the learning outcomes specified in the module description. Specifically, exam questions focus on the usage of vocabulary and grammar, as well as reading comprehension and text production. Listening comprehension is tested by posing questions based on audio samples to which students respond in writing.
Verbal skills are evaluated using appropriate prompts from sample print dialogs.

Repeat Examination:

(Recommended) Prerequisites:
Firm knowledge of level A1.2; placement test with the achievement A2.1

Content:
In this module, students acquire basic knowledge of the German language, including intercultural and regional aspects, that will enable them to express themselves in everyday situations, such as traveling, at the doctor's office, searching for an apartment, in a department store, among colleagues, friends or neighbors.
Students learn and practice basic vocabulary and expressions on topics such as education, profession, health and traveling. They learn and practice classifying and using an extended spectrum of main and subordinate clauses (final clause, indirect questions, temporal subordinate clause, causal sentence). They learn to employ the preterit (modal verbs) and perfect, how to use the comparative and the superlative, as well as the declination of the adjective (in the nominative, accusative and dative case). They also reinforce and expand the usage of prepositions in the accusative and dative case.

Students learn strategies for successful verbal and written communication despite minimal language skills. Opportunities will be made available for effective, self-motivated, independent learning. Students acquire teamwork skills through collaborative work in multinational mixed groups.

Intended Learning Outcomes:
The module is based on level A2 of GER.
Upon completion of this module, students are able to understand and use simple sentences and expressions in conversations on a broad spectrum of familiar topics. These conversations are based on basic information concerning everyday life and subjects relevant to studying or working, including sociocultural aspects of German-speaking countries.
For example, students are able to describe themselves and other people, their living situation, state of health, leisure time activities and job situation. Students are able to communicate in various situations, for example, when searching for an apartment, traveling or on holiday, and are able to report about their experiences in simple standard language.
Students are able to understand longer texts and letters about familiar topics that include foreseeable information and are written in simple language about everyday life or job related topics. Students have the ability to compose short, informative texts or notifications about basic situations in everyday life or situations related to studying.

Teaching and Learning Methods:
The module consists of a seminar covering material appropriate to desired learning outcomes and encompassing relevant listening, reading, writing and speaking exercises. These exercises may take the form of individual, partner or group work, implementing a communicative and activity-oriented approach. Students have the opportunity to deepen basic knowledge conveyed in the seminar through independent study and work, using specified (online) materials covering fundamental grammar and communication patterns of the foreign language.
Voluntary homework (preparation and follow-up work) reinforces classroom and structured learning.

Media:
Textbook; multimedia-based teaching and learning materials (black board, overheads, exercise sheets, image, film, etc.) also online

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.

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