JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

Faculty 09

Summer Semester 2024

As of 12.02.2024

Module Directory

Faculty 09 - Agricultural Sciences, Nutritional Sciences and Environmental Management

"Agrobiotechnology" Master Degree Course Modules

Please consult the timetable or current university calendar for information regarding dates and room numbers of the modules taught in the course:

http://www.uni-giessen.de/cms/fbz/fb09/studium/msc/stpl

Core Modules

MK-002-EN	MK-002-EN Applied Statistics Applied Statistics	6 CP
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding II Offered for the first time: WS 2015/16 Intake capacity: not limited	1./2. Sem.;

Frequency and Duration: WS, 1 semester

Module Coordinator: Chair of Biometry and Population Genetics

Applies to the Study Programmes: Agrobiotechnology, Master (1./2.); Insect Biotechnology and Bioresources, Master (1./2.);

Prerequisites for Participation: None

Learning Outcomes:
The Students
- have knowledge of statistical methods;
- have knowledge of experimental designs;
- are able to analyse experiments and studies.

Module Content:
- Analysis of variance
- Comparison of treatments
- Mixed linear models
- Experimental designs
- Data analysis using statistical software

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	30	60
Seminar		
Practical training	30	60
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Assignments (4) or written examination
- Components of final grade: Assignments (100 %) or written examination (100 %)
- Form of module retake examination: Written examination

Language: English

<table>
<tr><td rowspan="2">MK-007-EN</td><td>MK-007-EN Animal Nutrition and Feed Science</td><td rowspan="2">6 CP</td></tr>
<tr><td>Animal Nutrition and Feed Science</td></tr>
<tr><td rowspan="3">Core Module / Optional Module</td><td>Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Animal Nutrition and Nutrition Physiology</td><td rowspan="3">1./2. Sem.;</td></tr>
<tr><td>Offered for the first time: SS 2016</td></tr>
<tr><td>Intake capacity: not limited</td></tr>
<tr><td colspan="3">Frequency and Duration: SS, 1 Semester</td></tr>
<tr><td colspan="3">Module Coordinator: Chair of Animal Nutrition</td></tr>
<tr><td colspan="3">Applies to the Study Programmes: Agrobiotechnology, Master (1./2.);</td></tr>
<tr><td colspan="3">Prerequisites for Participation: None</td></tr>
<tr><td colspan="3">Learning Outcomes:
The students
• can describe the basics of digestion and the metabolism of the main nutrients;
• know the parameters of the metabolic rate and the energy evaluation systems;
• have an overview about origin, quality criteria, quality management, conservation and use of animal feeds;
• know the basics of the animal feed legislation;
• can apply the different feeding systems for farm animals in formulating feeding recipes;
• understand the relations between nutrition and performance, nutrient loss, animal health and product quality.</td></tr>
<tr><td colspan="3">Module Content:
• nutritional physiology of farm animals
• chemical composition (food, animal)
• digestion and utilization of nutrients (carbohydrates, proteins, lipids)
• metabolic rate and energy evaluation systems
• minerals and vitamins (functional significance, feed situation)
• characteristics, quality criteria and chief applications of animal feed
• basics of feed conservation, storage and preparation
• nutrition of farm animals
• energy and feed demand of farm animals during the breeding, reproduction and growing phase
• feeding strategies and feeding recipes
• nutritional influence on performance, nutrient loss, health and product quality</td></tr>
</table>

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	54	108
Seminar		
Practical training		
Exercises	6	12
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100 %)
- Form of module retake examination: Written examination

Language: English

MK-011-EN	**MK-011-EN Lab Course Biochemistry** **Lab Course Biochemistry**	**6 CP**
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Nutritional Sciences Offered for the first time: SS 2016 Intake capacity: 30	1. Sem.;

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Biochemistry and Molecular Biology

Applies to the Study Programmes: Agrobiotechnology, Master (1.);

Prerequisites for Participation: None (recommended: knowledge in chemistry and Biochemistry)

Learning Outcomes:
The Students

- have knowledge and proficiency in the application of molecular biology, spectrophotometric and chromatographic methods;
- are experienced and proficient in techniques of protein biochemistry and cell biology;
- have knowledge of the qualitative and quantitative value of biochemical, cell biological, molecular biological, and enzymatic analytic processes.

Module Content:

- primer design, PCR, cloning, use of restriction enzymes, ligation into vectors
- transformation of Escherichia coli
- heterologous overexpression of genes relevant to agrobiotechnology
- production of recombinant proteins in genetically altered bacteria
- purification of proteins with affinity chromatography
- SDS-PAGE analysis and Coomassie staining for detection and quality of control of recombinant proteins
- spectrophotometric analysis
- Functional assays for chaperone activity
- crystallization of proteins, x-ray diffraction analysis and alternative methods of structure determination

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture		
Seminar	20	40
Practical training	40	80
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100 %)
- Form of module retake examination: Written examination

Language: English

MK-015-EN	MK-015-EN Plant Protection and Bioengineering	6 CP
	Plant Protection and Bioengineering	
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Phytopathology	1./2. Sem.;
	Offered for the first time: WS 2015/16	
	Intake capacity: not limited	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Phytopathology

Applies to the Study Programmes: Agrobiotechnology, Master (1./2.);

Prerequisites for Participation: None (recommended: Basic knowledge in plant pathology and molecular biology)

Learning Outcomes:
The Students
- are able to understand and evaluate industrial strategies for disease control;
- have experience with basic biotechnological processes, such as tissue culture, high-throughput screening and pesticide applications;
- have a conception of the implementation impacts of plant biotechnology;
- have a command of the most important transformation techniques in the production of genetically modified plants;
- have a theoretical background of the biological mechanismus modern plant protection is based on.

Module Content:
- transgenic plants
- agronomically significant genes
- biotechnological disease control techniques
- tissue techniques and tissue cultures
- high-throughput screening methods
- industrial strategies in plant protection

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	40	70
Seminar	30	40
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Written examination and presentation (10-20 min.)
- Components of final grade: Written examination (75 %) and presentation (25 %)
- Form of module retake examination: Oral examination or written examination

Language: English

MK-016-EN	**MK-016-EN Biotechnology and Genomics** **Biotechnology and Genomics**	**6 CP**
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding I Offered for the first time: SS 2016 Intake capacity: not limited	2. Sem.;

Frequency and Duration: SS, 1 Semester

Module Coordinator: Chair of Plant Breeding

Applies to the Study Programmes: Agrobiotechnology, Master (2.);

Prerequisites for Participation: None (recommended: Knowledge of molecular genetics)

Learning Outcomes:
The students
- have deep theoretical knowledge about genome analysis methods methods, with an emphasis on plant genome mapping and gene expression techniques;
- gain insight into the practical applications of biotechnological and molecular genetic methods in plant breeding;
- have the necessary theoretical background to apply experimental molecular genetics, biotechnological and gene technological methods in plant breeding.

Module Content:
- Molecular and cellular plant genetics
- Methods and techniques of experimental biotechnology and genome analysis
- Molecular plant breeding: Structure and function of plant genomes, molecular markers, genome mapping, QTL analysis, gene cloning techniques, gene expression methodology
- Methods of gene technology in plant breeding: Gene isolation, gene transfer (transformation techniques), detection methods

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	50	70
Seminar		
Practical training		
Exercises		
Excursion	20	20
Total:	160	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Written examination and seminar paper (4 pages)
- Components of final grade: Written examination (80%), seminar paper (20%)
- Form of module retake examination: Written examination

Language: English

<table>
<tr><td rowspan="2">MK-018-EN</td><td>MK-018-EN Microbial Food Biotechnology</td><td rowspan="2">6 CP</td></tr>
<tr><td>Microbial Food Biotechnology</td></tr>
<tr><td rowspan="3">Core Module / Optional Module</td><td>Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Applied Microbiology</td><td rowspan="3">2./4. Sem.;</td></tr>
<tr><td>Offered for the first time: SS 2016</td></tr>
<tr><td>Intake capacity: 30</td></tr>
<tr><td colspan="3">Frequency and Duration: SS, 1 Semester</td></tr>
<tr><td colspan="3">Module Coordinator: Chair of Microbiology of Recycling Processes</td></tr>
<tr><td colspan="3">Applies to the Study Programmes: Agrobiotechnology, Master (2./4.);</td></tr>
<tr><td colspan="3">Prerequisites for Participation: None</td></tr>
<tr><td colspan="3">Learning Outcomes:
Students
• will have knowledge of the industrial microbiological processes employed in industrial settings, including genetic engineering applications;
• be familiar with advanced application-oriented microbiological methods within the scope of industrial microbiology;
• know basic and advanced microbiologcal and molecular techniques for control purposes.</td></tr>
<tr><td colspan="3">Module Content:
• food fermentations, Selected examples: Dairy products, wine, beer, fermented vegetables
• microbial production systems, Vinegar, citric acid, acetone, amino acids as primary products of microbial metabolism
• antibiotics, toxins (e.g. as insecticides) as secondary products of microbial metabolism
• microbial transformation and biocatalysis
• genetic engineering of microorganisms for optimal production
• foodborne pathogenic bacteria, Selected examples: Salmonella, enterohemorrhagic bacteria, Clostridium
• epideminology of foodborne illness
• Insects and other vectors for microbial spoilage
• Inhibition of microbial growth by physical or chemical methods
• Diagnostics in the food quality control (microbial contamination), micro- and molecular microbiological methods (selective pathogen cultivation), phylogenetic identification (Sangersequencing, 16S rRNA gene sequence analysis), epidemiological analysis of pathogens (MLST), resistance profiling, determination of toxicity and virulence genes, quantitative PCR, Salmonella diagnostics</td></tr>
</table>

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	30	60
Seminar		
Practical training	30	60
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Written examination and report of the practical exercises (5-7 pages)
- Components of final grade: Written examination (80 %), report of the practical exercises (20 %)
- Form of module retake examination: Written examination

Language: English

MK-057-EN	MK-057-EN Molecular Phytopathology Molecular Phytopathology	6 CP
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Phytopathology Offered for the first time: WS 2015/16 Intake capacity: not limited	1. Sem.; 1./2. Sem.;

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Phytopathology

Applies to the Study Programmes: Agrobiotechnology, Master (1.); Nutzpflanzenwissenschaften, Master (1./2.); Oenologie, Master (1./2.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- have in-depth knowledge of the biochemical and molecular basis on host-parasite interactions;
- are able to describe the structure and function of the plant's immune system of model plants;
- are able to discuss possible means by which plants and their parasites coevolved.

Module Content:
- cytological, biochemical and molecular biological foundations background on host-parasite interactions
- mechanisms of plant defensive reactions
- structure and function of resistance and virulence genes
- principles of modern disease control processes on the basis of induced resistance and genetic engineering techniques
- effector biology, PAMP-triggered immunity, effector triggered immunity

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	60	120
Seminar		
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100 %)
- Form of module retake examination: Oral examination or written examination

Language: English

MK-116-EN	MK-116-EN Principles of Scientific Practice	6 CP
	Principles of Scientific Practice	
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding I	1. Sem.; 2. Sem.;
	Offered for the first time: SS 2021	
	Intake capacity: not limited	

Frequency and Duration: WS and SS, 1 Semester

Module Coordinator: Chair of Agrobioinformatics

Applies to the Study Programmes: Agrobiotechnology, Master (1.); Insect Biotechnology and Bioresources, Master (2.);

Prerequisites for Participation: None

Learning Outcomes:
The students

- understand principles of scientific methods, scientific recording and scientific reporting;
- are able to formulate testable research hypotheses and design experiments to answer scientific questions;
- understand requirements and reporting standards for statistical analysis;
- understand how to generate and communicate scientific knowledge;
- are familiar with guidelines for good scientific practise;
- are able to locate reliable, quality-assured information representing the accepted status quo in regard to a specific scientific question;
- are able to correctly use and cite scientific sources in written work and presentations.

Module Content:

- Scientific methods
- Scientific hypotheses
- Experimental design
- Generation, recording and communication of scientific knowledge
- Good scientific practice
- Types and sources of scientific information

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	30	60
Seminar	10	20
Practical training		
Exercises	20	40
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Written examination or oral examination
- Components of final grade: Written exaiamination (100% or oral examination (100 %)
- Form of module retake examination: Written examination or oral examination

Language: English

Profile Modules

MK-067-EN-DI	MK-067-EN-DI Theory and Practice of Economic Development	6 CP
	Theory and Practice of Economic Development	
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agricultural Policy and Market Research	1. Sem.;
	Offered for the first time: WS 2021/22	
	Intake capacity: not limited	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Agricultural, Food and Environmental Policy

Applies to the Study Programmes: Transition Management, Master (1.); Sustainable Transition, Master (1.);

Prerequisites for Participation: None

Learning Outcomes:
Students

- are familiar with key concepts for analysing economic development.
- are able to apply them to a range of current development topics.
- are aware of the role of natural resources and institutions in the process of development.
- consider economic development as a multidisciplinary topic and are enabled to integrate viewpoints from neighbouring social sciences into a problem-centred approach

Module Content:

- Models of growth & development
- Trade & globalisation
- Development strategy & industrial policy
- Resource curse
- Land tenure
- Environment & the commons
- Institutions & development

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	60	120
Seminar		
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Written examination and assignments (5-10) or assignments (5-10)
- Components of final grade: Written examination (40 %), assignment (60 %) or assignment (100 %)
- Form of module retake examination: Written examination and assignments (5-10) or assignments (5-10)

Language: English

MK-068-EN	MK-068-EN Empirical Research Methods	6 CP
	Empirical Research Methods	
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agricultural Policy and Market Research	1. Sem.;
	Offered for the first time: WS 2015/16	
	Intake capacity: not limited	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Agricultural, Food and Environmental Policy

Applies to the Study Programmes: Transition Management, Master (1.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- have acquired knowledge of general principles of various qualitative and quantitative research methods as well as evaluation research
- are able to understand the application of various methods with regard to research objectives

Module Content:
- Principles of applied statistics
- Correlation and causality
- Basic approach of econometrics
- Basic introduction to simple and multiple regression analysis
- Collecting and analysing panel data
- Designing of surveys, interviews, questionnaires
- Qualitative data collection techniques
- Qualitative data analysis
- Mixed methods

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	30	60
Seminar	30	60
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: Written examination or written examination, seminar paper (4-5 pages) and poster

Module Examination:
- Form(s) of assessment: Written examination (100 %) or written examination (70 %), seminar paper (15 %), poster (15 %)
- Components of final grade: Written examination
- Form of module retake examination:

Language: English

MK-080-EN-DI	**MK-080-EN-DI Resource Economics and Sustainable Development**	6 CP
	Resource Economics and Sustainable Development	
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agricultural Policy and Market Research	1./2. Sem.; 2. Sem.;
	Offered for the first time: SS 2022	
	Intake capacity: not limited	

Frequency and Duration: SS, 1 Semester

Module Coordinator: Chair of Agricultural, Food and Environmental Policy

Applies to the Study Programmes: Agrar- und Ressourcenökonomie, Master (1./2.); Sustainable Transition, Master (2.);

Prerequisites for Participation: None

Learning Outcomes:

The Students

- know basic management/decision rules of optimal resource use;
- understand the concepts of static and dynamic efficiency of resource use;
- understand the concept and the meaning of externalities;
- understand the theoretical concepts of sustainability and optimal use of (non-) renewable resources;
- know the characteristics of energy/electricity markets with fossil and renewable energies;
- are familiar with the current climate and energy policy.

Module Content:

- Natural resources
- Renewable and non-renewable resources
- The sustainability problem
- Sustainable economic development
- Static and dynamic efficiency
- Overview of energy markets with renewable energies
- Electricity and its technical and economic characteristics
- Climate change and climate policy (emissions trading)

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	60	120
Seminar		
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Assignments (4-8) or written exam or written exam and assignments (4-6)
- Components of final grade: Assignments (100 %) or written exam (100 %) or written exam (50 %), assignments (50 %)
- Form of module retake examination: Assignments (4-6) or oral examination

Language: English

MK-087-EN	MK-087-EN Natural Product Chemistry	6 CP
	Natural Product Chemistry	
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology	1. Sem.;
	Offered for the first time: WS 2017/18	
	Intake capacity: 30	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Natural Substance Research with a Focus on Insect Biotechnology

Applies to the Study Programmes: Insect Biotechnology and Bioresources, Master (1.);

Prerequisites for Participation: None (recommended: knowledge in organic chemistry)

Learning Outcomes:
The students
- have comprehensive insight into the chemistry of organic natural products;
- know the most important classes of natural products, including their biosynthesis, important structural and chemical features as well as bioactivities.

Module Content:
- Bioresources (=origin), biosynthesis, ecophysiological role, and practical importance of natural products, thereby emphasizing insect-derived and 'anti-insect' compounds
- classes of natural products (carbohydrates, lipids, polyketides, phenylpropanoids, terpenes, peptides (non-ribosomally and ribosomally synthesized), and alkaloids) as well as their biosynthesis and important features (structure-activity relationships, toxicity)
- Methods section: Introduction to production/fermentation, isolation, purification of natural products (several (column) chromatographic techniques, especially HPLC), and structure elucidation

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	30	60
Seminar	30	60
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Written examination and presentation (10-15 min.)
- Components of final grade: Written examination (60 %), presentation (40 %)
- Form of module retake examination: Written examination or oral examination

Language: English

MK-088-EN	MK-088-EN Entomology I Entomology I	6 CP
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology Offered for the first time: WS 2017/18 Intake capacity: 30	1. Sem.;

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Applied Entomology

Applies to the Study Programmes: Insect Biotechnology and Bioresources, Master (1.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- gain fundamental knowledge of insects as a central bioresource;
- study insect anatomy and systematics;
- know the basics of insect identification and will learn ist practical application;
- learn techniques of preservation of insect specimens;
- understand the basics of evolutionary biology & ecology of insects.

Module Content:
- studies on internal (including dissections) and external insect morphology
- microscopy of organ systems
- use of insect identification keys with real specimens
- evolutionary strategies of insects
- insect ecology

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	40	80
Seminar		
Practical training		
Exercises	20	40
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100 %)
- Form of module retake examination: Written examination

Language: English

MK-089-EN	MK-089-EN Insect Biotechnology and Integrated Pest Management	6 CP
	Insect Biotechnology and Integrated Pest Management	
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology	1. Sem.;
	Offered for the first time: WS 2017/18	
	Intake capacity: 40	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Insect Biotechnology in Plant Protection

Applies to the Study Programmes: Insect Biotechnology and Bioresources, Master (1.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- have important knowledge in various methods of biological pest control (including classical biological control, inundative releases, etc.);
- have competencies in biology and ecology as well as the use of physical and microbiological control procedures;
- know the basic principles of important biotechnological plant protection strategies;
- can assess how and to what extent individual techniques can be used within the framework of IPM strategies;
- can independently compile, summarize, and present literature on a given topic in a lecture

Module Content:
- The legal basis of integrated and biological plant protection
- Biology and ecology of agricultural pests and entomopathogens and their application possibilities in crop protection (production and application technology)
- Case studies on methods of classical biological pest control, inundative releases of antagonists (in the field and greenhouse), sterile insect technology and strategies for the promotion of natural enemies in agricultural ecosystems
- Use of pheromones (monitoring, mass capture, confusion, lure and kill) and other biotechnological plant protection methods in agriculture

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	44	88
Seminar	8	16
Practical training		
Exercises		
Excursion	8	16
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Written examination and presentation (10-20 min. + discussion 5-10 min.)
- Components of final grade: Written examination (50%), presentation (50%)
- Form of module retake examination: Written examination or oral examination

Language: English

MK-090-EN	MK-090-EN Bioresources for Natural Product Discovery **Bioresources for Natural Product Discovery**	6 CP
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology Offered for the first time: SS 2018 Intake capacity: 30	2. Sem.;

Frequency and Duration: SS, 1 Semester

Module Coordinator: Chair of Natural Substance Research with a Focus on Insect Biotechnology

Applies to the Study Programmes: Insect Biotechnology and Bioresources, Master (2.);

Prerequisites for Participation: None

Learning Outcomes:
The students

- gain insights into suitable bioresources for natural product discovery approaches and how discovery pipelines are set-up (biological activity-based platforms versus modern genomics / bioinformatics-driven pipelines);
- get knowledge in currently used and emerging natural product-producing microorganisms and their application in pharmaceutical, agricultural and food industry;
- acquire knowledge in the industrial value chain from spanning early discovery programs up to lead candidate identification and lead development;
- get experience in the application of bioinformatic tools for biosynthetic gene cluster identification;
- get insights into recent literature and acquire skills in selecting and presenting publications as well as other data in seminars.

Module Content:

- Systematics, biology, and ecology of microorganisms producing natural products
- Examples of plant-derived natural products
- Examples of natural products biosynthesis in microorganisms (physiology, gene regulation)
- From bioresource to product: Strategies to select and exploit bioresources for natural product discovery
- Principles and application of biological detection systems and their application in academic and industrial screening systems
- Target identification and target-based screening systems
- Analytical platforms in natural product identification
- Connection of gene clusters and metabolites: modern approaches for drug discovery
- Lead identification and strategies for lead development
- Seminar on recent approaches in drug discovery
- Demonstration / hands on training to gain insights into bioinformatics tools in drug discovery (using the antiSMASH platform as an example to exploit genome sequence information)

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	42	84
Seminar	9	18
Practical training		
Exercises	9	18
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Written examination, presentation (10-15 min.) and project work (group work: preparation of a video tutorial, 4-10 min)
- Components of final grade: Written exam (50 %), presentation (40 %), project work (10 %)
- Form of module retake examination: Written examination or oral examination

Language: English

MK-091-EN	MK-091-EN Entomology II Entomology II	6 CP
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology Offered for the first time: SS 2018 Intake capacity: 30	2. Sem.;

Frequency and Duration: SS, 1 Semester

Module Coordinator: Chair of Applied Entomology

Applies to the Study Programmes: Insect Biotechnology and Bioresources, Master (2.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- gain in-depth knowledge on insect anatomy;
- broaden their knowledge on insect systematics;
- increase their skills in insect identification;
- understand concepts of insect physiology;
- understand insect adaptations to environmental pressures;
- extend their knowledge about insect ecological strategies.

Module Content:
- microscopic studies on histological sections of insect tissues
- identification of specimens on family and species level
- specific taxonomic techniques
- insect physiology (including development)
- examples and concepts how insects adapt to their environment
- insect feeding strategies (including field observations)

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	28	56
Seminar		
Practical training		
Exercises	24	48
Excursion	8	16
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100 %)
- Form of module retake examination: Written examination

Language: English

<table>
<tr><td rowspan="2">MK-096-EN</td><td>MK-096-EN Sustainable Agroecosystems</td><td rowspan="2">6 CP</td></tr>
<tr><td>Sustainable Agroecosystems</td></tr>
<tr><td rowspan="3">Core Module / Optional Module</td><td>Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding II</td><td rowspan="3">1./2. Sem.;</td></tr>
<tr><td>Offered for the first time: SS 2019</td></tr>
<tr><td>Intake capacity: 40</td></tr>
<tr><td colspan="3">Frequency and Duration: SS, 1 Semester</td></tr>
<tr><td colspan="3">Module Coordinator: Chair of Organic Farming</td></tr>
<tr><td colspan="3">Applies to the Study Programmes: Nutzpflanzenwissenschaften, Master (1./2.);</td></tr>
<tr><td colspan="3">Prerequisites for Participation: None</td></tr>
<tr><td colspan="3">Learning Outcomes:
The students
• get insight knowledge in to the complexity of temperate and tropical agroecosystems under integrated, organic and agro-ecological production;
• can list and explain different biophysical factors, processes and interactions that control the functioning of agroecosystems;
• are able to critically examine agricultural practices and management strategies to increase/stabilize productivity and resource use efficiency, while minimizing negative impacts on the environment and ensuring socio-economic viability;
• practice scientific observation in the field;
• practically apply agroecologic principles;
• can explain and give examples of environmental and socio-economic challenges of farming enterprises;
• are able to address a topic by means of scientific methodologies.</td></tr>
<tr><td colspan="3">Module Content:
• Agriculture from a systems perspective
• Principles of agricultural sustainability
• Principles of integrated production, organic farming and agroecology
• Sustainability impacts of temperate and tropical agroecosystems covering the main crop commodities and land use systems (Arable, grassland, horticulture)
• Farming system innovations (e.g. agroforestry, relay cropping,push-pull systems)
• Introduction to action research
• Practical work in an experimental garden
• Writing and presenting own contributions to the given topics
• How to access a topic scientifically? Evaluation of various media sources (from brochure to scientific paper) for further successful communication and dissemination of climate change issues.
• Excursions to research and private farms</td></tr>
</table>

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture		
Seminar	40	80
Practical training		
Exercises		
Excursion	20	40
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Seminar paper (4-6 pages) and oral examination
- Components of final grade: Seminar paper (50%), oral examination (50%)
- Form of module retake examination: Oral examination

Language: English

MK-108-EN-DI	MK-108-EN-DI Renewable Energy Transition	6 CP
	Renewable Energy Transition	
Core Module / Optional Module	Mathematics and Computer Science, Physics, Geography / Physics	2. Sem.;
	Offered for the first time: SS 2022	
	Intake capacity: 40	

Frequency and Duration: SS, 1 Semester

Module Coordinator: Physics

Applies to the Study Programmes: Sustainable Transition, Master (2.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- acquire basic physics knowledge about energy production, transport, storage and consumption using fossil, nuclear and renewable sources
- understand the options and problems of various energy systems, including their impact on global climate and the global carbon and water cycles
- gain in-depth knowledge of renewable energy systems and their elements
- know how to identify and address challenges in the transition phase of energy systems that are related to socio-economic and cultural factors

Module Content:
- energy usage and conversion
- fossil and nuclear power plants
- climate change and acidification of oceans
- potential of wind, solar, hydro and geothermal energies
- energy transport and storage
- interference of energy sectors for industrial, residential, thermal and mobility applications
- socio-economic and cultural aspects and challenges related to energy scarcity and energy system transitions

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	36	72
Seminar	24	48
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Presentation and assignments
- Components of final grade: Presentation (50%), assignments (50%)
- Form of module retake examination: Assignments or oral examination

Language: English

MK-109-EN-DI	MK-109-EN-DI Climate Change and Economic Development	6 CP
	Climate Change and Economic Development	
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agricultural Policy and Market Research	1. Sem.;
	Offered for the first time: WS 2019/20	
	Intake capacity: 30	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Agricultural, Food and Environmental Policy

Applies to the Study Programmes: Sustainable Transition, Master (1.);

Prerequisites for Participation: None

Learning Outcomes:
The Students
- are aware of the international challenges in dealing with climate change;
- understand the climate change risks in different developing regions;
- are able to discuss the potential of climate change mitigation and adaptation strategies and ways to implement and finance them.

Module Content:
- Climate change and economic development in low-income countries
- The effects of climate change on the agricultural sector
- Coastal regions and islands that are endangered by flooding
- Migration and conflicts as possible consequences
- The potential of renewable energies in transition and developing countries

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	10	20
Seminar	50	100
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Seminar paper (15-25 pages) or seminar paper (10-15 pages) and presentation (10-15 min.) or presentation (15-20 min.)
- Components of final grade: Seminar paper (100 %) or seminar paper (50 %), presentation (50 %) or presentation (100 %)
- Form of module retake examination: Revision of the seminar paper or oral examination

Language: English

<table>
<tr><td rowspan="2">MK-110-EN-DI</td><td>MK-110-EN-DI Food Politics</td><td rowspan="2">6 CP</td></tr>
<tr><td>Food Politics</td></tr>
<tr><td rowspan="3">Core Module / Optional Module</td><td>Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Consumer Research, Communication and Food Sociology</td><td rowspan="3">2. Sem.;</td></tr>
<tr><td>Offered for the first time: SS 2022</td></tr>
<tr><td>Intake capacity: 30</td></tr>
<tr><td colspan="3">Frequency and Duration: SS, 1 Semester</td></tr>
<tr><td colspan="3">Module Coordinator: Chair of Food Sociology</td></tr>
<tr><td colspan="3">Applies to the Study Programmes: Sustainable Transition, Master (2.);</td></tr>
<tr><td colspan="3">Prerequisites for Participation: none</td></tr>
<tr><td colspan="3">Learning Outcomes:
The students
• understand historical developments of public debates in the arena of food and politics and thereby develop the ability to question norms, practices and opinions and to take an own position in the sustainability discourse;
• distinguish the political and moral meaning of food to reflect their own role in local communities and global society;
• analyse problems and developments around consumption, production and regulation in food systems to identify and understand relationships;
• formulate an argument about a specific food problem in order to understand and reflect on the norms and values underlying actions. A special focus lies on sustainability-related values, principles and goals, being able to negotiate them in the context of conflicts of interest and necessary compromises, of uncertain knowledge and contradictions;
• critically reflect the approaches of various actors who aim to influence the food system and apply different problem-solving approaches to complex sustainability problems.</td></tr>
<tr><td colspan="3">Module Content:
This module introduces you to food as a political issue such as hunger, food security, malnutrition, sustainability, power politics, social justice or cultural identity. Food politics is about the political nature of food from fork to farm as well as from local to global levels. Topics might include:
• food production safety, labelling, and nutrition;
• environmental concerns ranging from organic farming and sustainable agriculture to consumption and waste disposal;
• politics of specific foods and foodways (e.g. fast food, genetically modified foods, etc.);
• ethics of animal care and vegetarianism as politics of the everyday;
• politics of hunger and malnutrition food movements (e.g. slow food movement, food sovereignty movement) and other stakeholders.</td></tr>
</table>

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture		
Seminar	30	80
Practical training		
Exercises	30	40
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Written report (12 to 15 pages) or oral examination
- Components of final grade: Written report (100 %) or oral examination (100%)
- Form of module retake examination: Revision of the written report or oral examination

Language: English

MK-119-EN	MK-119-EN Population Genetics	6 CP
	Population Genetics	
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding II	1./2. Sem.;
	Offered for the first time: SS 2016	
	Intake capacity: not limited	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Biometry and Population Genetics

Applies to the Study Programmes: Nutzpflanzenwissenschaften, Master (1./2.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- know important population genetical models;
- are able to analyse population genetical data;
- are able to model and simulate population genetical processes.

Module Content:
- Models for single loci: genotype and allele frequencies, inbreeding, drift, selection
- Models for several loci: genetic maps, linkage disequilibrium
- Models for populations: genetic distances and visualization
- Genome wide association studies

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	30	60
Seminar		
Practical training	30	60
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Assignments (4) or written examination
- Components of final grade: Assignments (100 %) or written examination (100%)
- Form of module retake examination: Written examination

Language: English

MK-124-EN	MK-124-EN Nutritional Physiology of Crop Plants **Nutritional Physiology of Crop Plants**	6 CP
Core Module / Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Plant Nutrition Offered for the first time: WS 2022/23 Intake capacity: 40	1./2. Sem.;

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Plant Nutrition

Applies to the Study Programmes: Nutzpflanzenwissenschaften, Master (1./2.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- know the nutrient acquisition and transport mechanisms of crop plants;
- have sound knowledge of the physiological functions of plant nutrients, of photosynthesis and of plant energy metabolism;
- understand the role of nutrients for yield formation and the related physiological processes;
- can diagnose nutrient deficiency symptoms in crop plants.

Module Content:
- Nutrient acquisition and transport
- Diagnosis of nutrient deficiency
- Plant water relations
- Photosynthesis
- Energy metabolism of plants
- Nitrogen and sulfur assimilation
- Source-sink relations
- Storage processes

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	45	90
Seminar		
Practical training	15	30
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Oral exam and seminar paper (2000 - 2500 words; 4-6 weeks)
- Components of final grade: Oral exam (75 %), seminar paper (25 %)
- Form of module retake examination: Oral exam

Language: English

<table>
<tr><td rowspan="2">MK-127-EN</td><td>MK-127-EN Socio-Economic Perspectives on Food Systems</td><td rowspan="2">6 CP</td></tr>
<tr><td>Socio-Economic Perspectives on Food Systems</td></tr>
<tr><td rowspan="3">Core Module / Optional Module</td><td>Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agricultural Policy and Market Research</td><td rowspan="3">1./2. Sem.;</td></tr>
<tr><td>Offered for the first time: SS 2023</td></tr>
<tr><td>Intake capacity: not limited</td></tr>
<tr><td colspan="3">Frequency and Duration: SS, 1 Semester</td></tr>
<tr><td colspan="3">Module Coordinator: Chair of Agricultural, Food and Environmental Policy</td></tr>
<tr><td colspan="3">Applies to the Study Programmes: Nachhaltige Ernährungswirtschaft, Master (1./2.);</td></tr>
<tr><td colspan="3">Prerequisites for Participation: None</td></tr>
<tr><td colspan="3">Learning Outcomes:
The students
• know the many representations and definitions of food systems;
• understand the conceptual difference between value chains and food system;
• understand the analytical consequences of a system representation of human nutrition systems;
• know the current streams of economic thinking applied to food systems;
• know the current streams of socio-political thinking applied to food systems;
• know indicators for assessing the sustainability of food systems;
• have knowledge of the theoretical approaches to alternative nutrition systems.</td></tr>
<tr><td colspan="3">Module Content:
• Introduction to food systems: a small history of the concept
• Food Systems as socio-ecological systems
• Modeling food systems
• Economics and food systems
• Feminist economics, food systems and nutrition
• Food systems, food sovereignty and justice
• Alternative and decolonizing food systems
• In pursuit of sustainable food systems</td></tr>
</table>

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	20	40
Seminar	40	80
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Seminar paper (1000-3000 words) or written examination or presentation (10-30 min.) with written assignment (4-12 pages)
- Components of final grade: Seminar paper (100 %) or written examination (100 %) or presentation with written assignment (100 %)
- Form of module retake examination: Revision of the seminar paper or written examination or revision of the written assignment

Language: English

MP-007-EN	MP-007-EN Food and Nutrition Security and Development Food and Nutrition Security and Development	6 CP
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Offered for the first time: SS 2016 Intake capacity: 30	1.-4. Sem.;

Frequency and Duration: SS, 1 Semester

Module Coordinator: Chair of International Food and Nutrition Security

Applies to the Study Programmes: Profil englisch, Master (1.-4.);

Prerequisites for Participation: none

Learning Outcomes:
The students

- have a good understanding of all relevant topics in international food and nutrition security;
- are able to understand how these topics will contribute to food and nutrition security, using the UNICEF conceptual framework of malnutrition and death“;
- have a coherent knowledge of the management (including prevention, assessment & treatment) of all forms of malnutrition (marasmus, kwashiorkor, under- and overweight, stunting, wasting, micronutrient malnutrition);
- know basics of anthropometric measurements and other diagnostic tools;
- know preconditions of food and nutrition security;
- understand the contributions, advantages and disadvantages of international food assistance;
- know the importance of gender mainstreaming in nutrition security.

Module Content:

- Concept of Food and Nutrition Security (Unicef Modell)
- “Nutrition Transition, Double Burden of Malnutrition”
- Pathophysiology of malnutrition (Marasmus, Kwashiokor, Micronutrient malnutrition)
- Determinants of Food Security
- Population Development and Nutrition Security
- Food Assistance: Opportunities, Advantages and Disadvantages
- Anthropometric measurements
- Food Diversity and Assessment of Dietary Diversity (Dietary Diversity Scores)
- Healthy Environment (WASH and Food Safety) and Health Problems
- World Market and Fair Trade
- Gender and Nutrition Security
- Health Systems and Common Sicknesses (Including Management)

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	30	60
Seminar	30	60
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Essay (10 pages) and presentation (20-30 min.)
- Components of final grade: Essay (50 %), presentation (50 %)
- Form of module retake examination: Essay (10 pages) and presentation (20-30 min.)

Language: English

MP-020-EN	**MP-020-EN Plant Breeding for Resistance and Quality Breeding**	6 CP
	Plant Breeding for Resistance and Quality Breeding	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding I	2. Sem.;
	Offered for the first time: SS 2016	
	Intake capacity: not limited	

Frequency and Duration: SS, 1 Semester

Module Coordinator: Chair of Plant Breeding

Applies to the Study Programmes: Profil, Master (2.); Profil englisch, Master (2.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- will obtain profound knowledge about the breeding goals regarding disease resistances and quality aspects of important European crops
- will obtain profound knowledge about essential methods to record the respective resistance and quality attributes
- will obtain knowledge about how to realize breeding goals in the breeding process depending on the genetics and inheritance of the respective trait
- will obtain knowledge about the application of biotechnological, gene technological and molecular-biological tools with respect to optimising resistance and quality parameters of important agricultural crops

Module Content:
- natural diversity and genetics of resistance against the most important pests of major European crops
- detection methods for resistance reactions in selected crops
- detection methods for important quality parameters of selected crops
- natural diversity and genetics of quality parameters (cereals, oil and protein plants)
- methods to identify and increase genetic variation for important traits
- methods of cell and tissue culture and their use in breeding for resistance and quality

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	30	60
Seminar		
Practical training		
Exercises		
Excursion	30	60
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Oral examination and seminar paper (5-8 pages)
- Components of final grade: Oral examination (80 %), seminar paper (20%)
- Form of module retake examination: Oral examination or written examination

Language: English

MP-029-EN	MP-029-EN Plant-Microbe Interactions	6 CP
	Plant-Microbe Interactions	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Phytopathology	2./4. Sem.;
	Offered for the first time: SS 2016	
	Intake capacity: 60	

Frequency and Duration: SS, 1 Semester

Module Coordinator: Chair of Phytopathology

Applies to the Study Programmes: Profil, Master (2./4.); Profil englisch, Master (2./4.);

Prerequisites for Participation: None (recommended: basics in microbiology and phytopathology)

Learning Outcomes:
The Students
- are familiar with interactions of parasitic and symbiotic biocenoses;
- are able to discuss the application of alternative measures for reduction of pesticide and chemical fertilizers;
- are familiar with concepts of modern interdisciplinary approaches to the use of microorganisms in disease control.

Module Content:
- physical and chemical conditions in the rhizosphere (pH, O2, exudate gradients)
- root pathogens (fungi, bacteria)
- pest control strategies on roots
- growth promotion of rhizospheric microorganisms (N2 fixation, regulation of the nif gene, plant-promoting factors, mycorrhiza)
- resistance mechanisms
- possibilities and limitations of inoculation with VAM or N2-fixing bacteria
- interaction with beneficial microorganisms (PGPR, BCAs)
- microbial interactions with lower plants (mosses, lichens, etc.)
- methods for the study of uncultivable microorganisms on/in plant tissues

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	45	90
Seminar	15	30
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Written examination and Presentation (10-20 min.)
- Components of final grade: Written examination (75 %), Presentation (25 %)
- Form of module retake examination: Oral or written examination

Language: English

MP-076-EN	MP-076-EN Lab Course: Tissue Culturing and Genetic Transformation	6 CP
	Lab Course: Tissue Culturing and Genetic Transformation	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Phytopathology	1./3. Sem.;
	Offered for the first time: WS 2015/16	
	Intake capacity: 30	

Frequency and Duration: WS, Block, 1 Semester

Module Coordinator: Chair of Phytopathology

Applies to the Study Programmes: Profil, Master (1./3.); Profil englisch, Master (1./3.);

Prerequisites for Participation: Molecular Phytopathology (MK 057), Plant Protection and Bioengineering (MK 015)

Learning Outcomes:
The Students
- have practical knowledge of the methods, strategies, and laboratory techniques for plant and microbe transformation;
- are able to understand technical problems related to genetic transformation of crop plants, and identify the risks involved in this strategy;
- have fundamental knowledge in risk assessment, environment protection, farmer and consumer protection, and food security.

Module Content:
- guidance for the risk management of genetic engineered plant and microorganisms
- practical training in plant transformation
- practical training in microbe transformation techniques
- practical training in tissue culturing techniques
- practical training in detection of transgenes by molecular and cell biology techniques
- practical training in confocal laser microscopy
- practical training in transgene function assessment

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	5	10
Seminar	5	10
Practical training	50	100
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Oral examination, seminar paper (8 pages)
- Components of final grade: Oral examination (50%), seminar paper (50%)
- Form of module retake examination: Oral examination

Language: English

MP-077-EN	MP-077-EN Lab Course: Methods in Molecular Phytopathology	6 CP
	Lab Course: Methods in Molecular Phytopathology	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Phytopathology	1./3. Sem.;
	Offered for the first time: WS 2015/16	
	Intake capacity: 30	

Frequency and Duration: WS, Block, 1 Semester

Module Coordinator: Chair of Phytopathology

Applies to the Study Programmes: Profil, Master (1./3.); Profil englisch, Master (1./3.);

Prerequisites for Participation: Molecular Phytopathology (MK 057), Plant Protection and Bioengineering (MK 015)

Learning Outcomes:
The Students

- are acquainted with plant pathogenic organisms and will learn different inoculation techniques;
- know laboratory techniques in molecular biology;
- know different biotechnological strategies in plant protection;
- have a broad knowledge of plant microbe interactions;
- have knowledge about pathogen effector molecules and their targets in the host cell;
- have knowledge about protein-protein interactions.

Module Content:

- practical training in detection methods of DNA, RNA and proteins
- practical training in biotechnological plant protection strategies
- practical training in bioinformatics related to sequence similarities and diagnostic matter
- practical training in inoculation methods and disease assessment
- practical training in detection of protein-protein interactions

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	5	10
Seminar	5	10
Practical training	50	100
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Oral examination and presentation (10-20 min.)
- Components of final grade: Oral examination (50 %), presentation (50%)
- Form of module retake examination: Oral examination

Language: English

MP-090-EN	MP-090-EN Biotechnology for Pest Control	6 CP
	Biotechnology for Pest Control	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology	1./3. Sem.;
	Offered for the first time: WS 2015/16	
	Intake capacity: 40	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Insect Biotechnology in Plant Protection

Applies to the Study Programmes: Profil, Master (1./3.); Profil englisch, Master (1./3.);

Prerequisites for Participation: None (recommended: basic knowledge in zoology, biotechnology, and genetics)

Learning Outcomes:
The Students

- get an introduction to insect biotechnology;
- know about biotechnological applications of insect-derived bioresources in medicine, agriculture, and industry;
- know about the importance of genetic and epigenetic tools in model insect species;
- know about diseases transmitted by insets and comparative genomic analysis;
- know how to synthesize and prepare the seminar work on insect biotechnology and molecular entomology.

Module Content:

- concepts of insect biotechnology and relevant basics in insect immunity, physiology and epigenetics
- application of insect-derived bioresources in medicine, agriculture and industry
- a detailed view on environment friendly methods of pest control including molecular, transgenic and gene editing technologies

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	36	72
Seminar	24	48
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Written examination and presentation (7-20 min. + discussion 5-10 min.)
- Components of final grade: Written examination (50 %), presentation (50 %)
- Form of module retake examination: Oral examination or written examination or presentation

Language: English

MP-097-EN	MP-097-EN Microbial Diagnostics	6 CP
	Microbial Diagnostics	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Applied Microbiology	3./4. Sem.;
	Offered for the first time: WS 2015/16	
	Intake capacity: 30	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Microbiology of Recycling Processes

Applies to the Study Programmes: Profil, Master (3./4.); Profil englisch, Master (3./4.);

Prerequisites for Participation: None (recommended: Angew. und Umweltmikrobiologie (BK 034) and/or Lebensmittelmikrobiologie (BP 092))

Learning Outcomes:
The students
- have detailed knowledge of the fundamentals of microbial diagnostics;
- know methods of quantification and qualification of bacteria with cultivation-dependent and cultivation-independent methods;
- have knowledge on the “antibiotic-resistant priority pathogens” (WHO).

Module Content:
- microbiological diagnostics (conventional and molecular biological methods in the context of quality management measures), microbial contamination of food and the environment, in everyday life and in the working environment (legal foundations and standards)
- quantification and qualification of antibiotic-resistant priority pathogens; identification of bacteria with conventional and molecular biological methods; enzyme detection, bacteriological analyses in the context of microbiological quality control

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	30	60
Seminar	10	30
Practical training		
Exercises	20	30
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Presentation (10-15 min.) and written examination
- Components of final grade: Presentation (20 %), written examination (80 %)
- Form of module retake examination: Written examination

Language: English

MP-098-EN	MP-098-EN Molecular Plant Breeding	6 CP
	Molecular Plant Breeding	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding I	1.-4. Sem.;
	Offered for the first time: WS 2015/16	
	Intake capacity: 30	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Plant Breeding

Applies to the Study Programmes: Profil, Master (1.-4.); Profil englisch, Master (1.-4.);

Prerequisites for Participation: Biotechnology and Genomics (MK 016) / (recommended: Plant Breeding: Special Topics of Resistance and Quality Breeding (MP 020))

Learning Outcomes:
The students
- will gain practical and/or theoretical experience in DNA and RNA extraction and analysis techniques, PCR, genetic mapping and QTL analysis, DNA hybridisation, gene expression and next-generation sequencing
- will learn practical applications of biotechnological and molecular genetic methods in plant breeding
- will obtain the necessary practical background to apply experimental molecular genetics, biotechnological and gene technological methods in plant breeding

Module Content:
- Next-generation DANN sequencing
- Molecular marker analysis, genome mapping and QTL analysis
- DNA filter hybridisation, genome libraries
- Quantitative real-time PCR
- New methods of gene technology in plant breeding: Genome editing, cis-genestics

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	30	30
Seminar		
Practical training	40	80
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Oral examination and lab book (30-50 pages)
- Components of final grade: Oral examination (50 %), lab book (50 %)
- Form of module retake examination: Oral examination

Language: English

MP-145-EN	MP-145-EN Methods of Regional Analysis and Planning	6 CP
	Methods of Regional Analysis and Planning	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agricultural Policy and Market Research	1.-4. Sem.;
	Offered for the first time: WS 2015/16	
	Intake capacity: 30	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Agricultural and Food Market Analysis

Applies to the Study Programmes: Profil, Master (1.-4.); Profil GT, WW, Master (1.-4.); Profil englisch, Master (1.-4.);

Prerequisites for Participation: None

Learning Outcomes:
Students will

- recognize the necessity and purpose of demarcation and differentiations of rural regions
- have knowledge of the major methods of region differentiation
- know key analytic parameters for describing regional structures
- be able to apply quantitative methods for the analysis and forecasting of regional developments
- recognize the necessity of evaluation within the scope of regional and environmental planning
- be able to assess the advantages and disadvantages of various evaluation methods
- be able to select and apply adequate evaluation methods for various regional and environmental Planning
- consider the basics of project management

Module Content:

- principles of regional grouping and differentiation
- methods of regional demarcation
- statistical parameters of regional analysis
- complex indicators for describing regional structures
- methods of regional structural analysis
- regional models
- foundations of welfare theory
- evaluation methods
- application of evaluation methods to examples of regional and environmental planning
- project management in regional and environmental planning

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	40	80
Seminar		
Practical training		
Exercises	20	40
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Written examination and seminar paper
- Components of final grade: Written examination (80 %), seminar paper (20 %)
- Form of module retake examination: Oral examination

Language: English

MP-149-EN	MP-149-EN Molecular Techniques Molecular Techniques	6 CP
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology Offered for the first time: WS 2017/18 Intake capacity: 40	1./3. Sem.;

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Insect Biotechnology in Plant Protection

Applies to the Study Programmes: Profil, Master (1./3.); Profil englisch, Master (1./3.);

Prerequisites for Participation: None (good knowledge in genetics recommended)

Learning Outcomes:
The students
- have a basic knowledge of molecular biology;
- know important vector and plasmid systems;
- know important molecular pathways as well as cloning strategies;
- have a good knowledge of molecular techniques used in insect biotechnology.

Module Content:
- Fundamentals in molecular biology
- History and evolution of plasmids and DNA cloning
- Molecular biology and their benefits in biotechnology
- Transformation possibilities and transgenesis in insects
- "From plasmids to biotechnologically modified insects"
- Current molecular tools in insect biotechnology and their risk assessment

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	28	56
Seminar	24	48
Practical training		
Exercises	8	16
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100 %)
- Form of module retake examination: Written examination

Language: English

MP-150-EN	MP-150-EN Milestones of Insect Biotechnology & Bioresources	6 CP
	Milestones of Insect Biotechnology & Bioresources	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology	2./4. Sem.;
	Offered for the first time: SS 2018	
	Intake capacity: 40	

Frequency and Duration: SS, 1 Semester

Module Coordinator: Chair of Insect Biotechnology in Plant Protection

Applies to the Study Programmes: Profil, Master (2./4.); Profil englisch, Master (2./4.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- have an overview of currently discussed relevant topics in science and industry in the field of insect biotechnology;
- have an overview of currently discussed relevant topics in science and industry in the field of bioresources;
- Get an overview of research and presentation of current relevant publications and discussion within the context of the lecture, classification of potential industrial and social relevance.

Module Content:
- Discussion of regulatory and ethical topics on the use of insect biotechnology and the generation of novel products for pest control and human health
- presentation and discussion of currently important topics in insect biotechnology & bioresources
- literature research and presentation of currently relevant topics in pharmaceutical and industrial biotechnology based on publications

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	54	108
Seminar		
Practical training		
Exercises		
Excursion	6	12
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100 %)
- Form of module retake examination: Written examination

Language: English

MP-151-EN	MP-151-EN Antibiotics: Present, Past and Future	6 CP
	Antibiotics: Present, Past and Future	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology	2.-4. Sem.;
	Offered for the first time: WS 2018/19	
	Intake capacity: 30	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Natural Substance Research with a Focus on Insect Biotechnology

Applies to the Study Programmes: Profil, Master (2.-4.); Profil englisch, Master (2.-4.);

Prerequisites for Participation: Natural Product Discovery Platforms (MK 090)

Learning Outcomes:
The students
- get comprehensive insight into the main chemical classes of antibiotics used in human and veterinary medicine as well as for agricultural applications.

Module Content:
- Main chemical classes (ß-lactams, tetracyclins, aminoglycosides, macrolides, peptide antibiotics, 'hybrid' structures, others) of antibiotics used in human and veterinary medicine as well as for agricultural applications;
- Microbial secondary metabolism as the primary source of antibiotics, including biosynthesis of the most important classes;
- Modes of action and target sites of important classes of antibiotics;
- Resistance to antibiotics and novel strategies to overcome antibiotic resistance;
- Optimizing the effectiveness of antibiotics by chemical and biosynthetic modification (partial synthesis, precursor-directed biosynthesis etc.);
- Design & optimization of antibiotic fermentation processes;
- History of antibiotic research and to antimicrobial metabolites from other than microbial sources;

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	48	96
Seminar	12	24
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Written examination, presentation (10-15 min.) and project work (group work: video tutorial, 4-10 min. or written coursework, 1500-2000 words)
- Components of final grade: Written examination (50 %), presentation (30 %), project work (20 %)
- Form of module retake examination: Written examination or oral examination

Language: English

MP-158-EN	MP-158-EN Insects for Food and Feed Production Systems	6 CP
	Insects for Food and Feed Production Systems	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology	1.-4. Sem.;
	Offered for the first time: WS 2018/19	
	Intake capacity: 30	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Applied Entomology

Applies to the Study Programmes: Profil, Master (1.-4.); Profil englisch, Master (1.-4.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- learn analytical procedures used in the area of food and feed
- gain insight into processing systems for food production
- learn to identify edible insects and get information about their morphology, physiology, and ecology
- gain knowledge on strategies to convert waste to food
- present their research results in the form of a seminar talk

Module Content:
- biology of edible insects and introduction to different insect rearing systems
- basic methods used in modern food analysis
- Analysis of available databases and literature for suitable insects, protein requirements and improved waste management

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	42	84
Seminar	18	36
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Written examination and presentation (15 min.)
- Components of final grade: Written examination (75%), presentation (25%)
- Form of module retake examination: Written examination

Language: English

MP-163-EN-DI	MP-163-EN-DI Python for Environmental Scientists	6 CP
	Python for Environmental Scientists	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Landscape Ecology and Resources Management	1.-4. Sem.;
	Offered for the first time: WS 2018/19	
	Intake capacity: 30	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Landscape, Water and Biogeochemical Cycles

Applies to the Study Programmes: Profil englisch digital, Master (1.-4.); Profil, Master (1.-4.); Profil englisch, Master (1.-4.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- understand the basic concepts of Python;
- can work with data from different sources and formats;
- know common scientific Python packages and what they are used for;
- can perform basic time series analysis;
- can create graphics for environmental data;
- can perform basic statistics in Python.

Module Content:
- Basic concepts of Python
- Scientific Python packages like numpy, matplotlib, pandas
- Using data form different formats
- Plotting in Python
- Time series analysis in Python
- Statistics in Python

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	15	30
Seminar		
Practical training		
Exercises	45	90
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Seminar paper (5-7 pages) and presentation (10 - 15 min)
- Components of final grade: Seminar paper (50 %), presentation (50 %)
- Form of module retake examination: Revision of the seminar paper

Language: English

MP-175-EN	MP-175-EN Effect-directed Analysis by HPTLC-Assay-HRMS	6 CP
	Effect-directed Analysis by HPTLC-Assay-HRMS	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Nutritional Sciences	1.-4. Sem.;
	Offered for the first time: WS 2018/19	
	Intake capacity: not limited	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Food Sciences

Applies to the Study Programmes: Profil, Master (1.-4.); Profil englisch, Master (1.-4.);

Prerequisites for Participation: None

Learning Outcomes:
The students

- understand possible options and the importance of effect-directed analysis;
- know the advantages and disadvantages of the different techniques;
- recognise the diversity of in-situ or on-surface assays;
- know the streamlined workflow on one plate, i.e. separate complex samples in parallel, detect and characterise active substances;
- recognize the highly efficient combination of of high performance thin layer chromatography (HPTLC) coupled with biological and biochemical assays;
- can understand the rapid effect-directed profiling of samples (5-15 min per sample);
- understand how metabolization of samples and effect-directed profiling of samples can be performed and linked together;
- know how to perform adherent human cell assays on-surface;
- understand how to go from parallel screening of many samples to molecular formulae of the bioactive compounds on a single plate.

Module Content:

- Theoretical basics of the different options for the performance of effect-directed analysis,
- Advantages of coupling the different assays with HPTLC,
- Different options for couplings to mass spectrometry (MS),
- Training in the HPTLC-UV/Vis/FLD assay-MS workflow using different types of assays:
    1. Antimicrobial compounds against Gram-negative bacteria via the Aliivibrio fischeri bioassay.
    2. Antimicrobial compounds against Gram-positive bacteria via the Bacillus subtilis bioassay
    3. Hormonally active compounds via planar yeast estrogen/androgen screens (pYES/pYAS)
    4. Multiplex assays to detect and clarify antagonistic and synergistic effects
    5. Enzyme inhibition assays for the inhibition of acetylcholinesterase, butyrylcholinesterase, tyrosinase, a- or ß-glucosidase, a-amylase and ß-glucuronidase
    6. Digestion of samples by means of NanoGIT+active
    7. Metabolization or toxification/detoxification by the S9 liver enzyme system
    8. Adherent human cell assays
- Optional lab day with illustration of effect-directed experiments

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	56	120
Seminar		
Practical training	4	
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100 %)
- Form of module retake examination: Written examination

Language: English

MP-196	MP-196 Internship Berufspraktikum	12 CP
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Offered for the first time: WS 2019/20 Intake capacity: not limited	1. - 4. Sem.;

Frequency and Duration: WS and SS, 1 Semester

Module Coordinator: Study deanery

Applies to the Study Programmes: Profil englisch, Master (1. - 4.); Profil, Master (1. - 4.);

Prerequisites for Participation: Keine

Learning Outcomes:
The Students
- gain in-depth experience as interns in future fields of activity and professions;
- have practical knowledge and skills from their internship companies and understand the connection between study and practice;
- concretise their personal career perspectives (career planning).

Module Content:
- Development of future occupational fields
- Practical experience in companies in the fields of agricultural sciences, environmental sciences, ecotrophology and nutritional sciences
- Reflection on one's own practical professional activity

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture		
Seminar		
Practical training	360	
Exercises		
Excursion		
Total:	360	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Internship report (tasks, activities, acquired knowledge and skills, reflection). The report must be assessed as "passed".
- Components of final grade: Formation of the module mark: ungraded performance
- Form of module retake examination: Revision of the internship report

Language: German and/or English

MP-208-EN-DI	MP-208-EN-DI Concepts of Ecological Economics **Concepts of Ecological Economics**	6 CP
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agricultural Policy and Market Research Offered for the first time: SS 2020 Intake capacity: 30	1.-4. Sem.;

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Agricultural, Food and Environmental Policy

Applies to the Study Programmes: Profil englisch digital, Master (1.-4.); Profil, Master (1.-4.); Profil GT, WW, Master (1.-4.); Profil englisch, Master (1.-4.);

Prerequisites for Participation: None

Learning Outcomes:
The students

- know about ecological economics and political ecology as analytical concepts to assess challenges in the sustainable use of natural resources in the world, and especially natural resource use conflicts between different agents.
- understand the difference between neo-classical economic models, environmental economics and ecological economics.
- can explain the basic assumptions held in ecological economics
- can identify work domain in which ecological economics is appropriate and formulation questions which can be answered by using approaches rooted in ecological economics.
- know by name and by basic concept several different analytical methods used in ecological economics
- know in-depth about one analytical methods and are in a position to convey their knowledge to peers

Module Content:

- Introduction to ecological economics and position with regard to other neo-classical economics of natural resources
- Context of use of ecological economics and history of development: conflicts in natural resource use
- Main assumptions underlying ecological economics
- Different methods and approaches used in ecological economics studies
- Role of political aspects in the use of natural resources

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	20	40
Seminar	40	80
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Homework, presentation (10-30 min.) with written report (between 4 and 12 pages) and seminar paper (1000 bis 2500 Wörter)
- Components of final grade: Homework (30 %), presentation with written report (40 %) and seminar paper (30 %)
- Form of module retake examination: Oral examination

Language: English

<table>
<tr><td rowspan="2">MP-209-EN</td><td>MP-209-EN Field-Work based Research in Socio-Economics</td><td rowspan="2">6 CP</td></tr>
<tr><td>Field-Work based Research in Socio-Economics</td></tr>
<tr><td rowspan="3">Optional Module</td><td>Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agricultural Policy and Market Research</td><td rowspan="3">1.-4. Sem.;</td></tr>
<tr><td>Offered for the first time: WS 15/16</td></tr>
<tr><td>Intake capacity: 20</td></tr>
<tr><td colspan="3">Frequency and Duration: WS, 1 Semester</td></tr>
<tr><td colspan="3">Module Coordinator: Chair of Agricultural, Food and Environmental Policy</td></tr>
<tr><td colspan="3">Applies to the Study Programmes: Profil, Master (1.-4.); Profil englisch, Master (1.-4.);</td></tr>
<tr><td colspan="3">Prerequisites for Participation: None (Participants need to bring a research idea and a draft proposal for a research project.)</td></tr>
<tr><td colspan="3">Learning Outcomes:
The students
• are informed about the usual proposal structure
• learn evaluation criteria for the quality of the proposal
• are comfortable with the terms, research questions, empirical questions, main research hypothesis/claim, and research design.
• practice in operationalizing the concepts in their own work and the work of others for the planning of research activities
• learn about mixed methods and plan a research design for their proposal
• reflect on writing for an audience
• are introduced to thinking about the art of conducting research
• practice peer-reviewing.
• learn about good scientific practices regarding their field work in aspects of:
o Organization
o Ethics and data protection
o Digital data collection for questionnaires.
• can recognize ethical dilemmas in the conduction of research.</td></tr>
<tr><td colspan="3">Module Content:
• Access to land in Africa (land rights, land markets, land reform, social and human implications of the land reform)
• Land management (impacts of land use, stakeholders,
• Sustainable land management, land governance, case studies</td></tr>
</table>

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	54	100
Seminar	6	20
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Written examination, presentation (10-15 min.), seminar paper (5-8 pages)
- Components of final grade: Written examination (50 %), presentation (25 %), seminar paper (25 %)
- Form of module retake examination: Written examination

Language: English

MP-214-EN	MP-214-EN Econometrics and Modelling Applications	6 CP
	Econometrics and Modelling Applications	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agricultural Policy and Market Research	1.-4. Sem.;
	Offered for the first time: SS 2020	
	Intake capacity: 30	

Frequency and Duration: SS, 1 Semester

Module Coordinator: Chair of Agricultural, Food and Environmental Policy

Applies to the Study Programmes: Profil englisch, Master (1.-4.); Profil, Master (1.-4.);

Prerequisites for Participation: None

Learning Outcomes:
The students

- know the basic aspects of econometrics and economic modelling methods that are common in international, environmental and development economics;
- have profound knowledge about the application possibilities of different methods with their advantages and limitations and the interpretation of the application results;
- can critically reflect and interpret scientific articles using such methods, review these articles in their seminar paper and present them;
- know how to write a methodology-based thesis in the future.

Module Content:

- Introduction to economic models and scenario simulations
- Overview of applied econometric methods
- Development, agriculture, environment, climate and trade policy
- Technological cooperation with developing countries in the areas agriculture and technology

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	8	16
Seminar	52	104
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Seminar paper (10-20 pages) or seminar paper (10-12 pages) and presentation (10-15 min.) or presentation (15-20 min.)
- Components of final grade: Seminar paper (100 %) or seminar paper (60 %), presentation (40 %) or presentation (100 %)
- Form of module retake examination: Revision of the seminar paper or oral examination

Language: English

MP-215-EN	MP-215-EN Regulation of Agricultural Value Chains	6 CP
	Regulation of Agricultural Value Chains	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agricultural Policy and Market Research	1.-4. Sem.;
	Offered for the first time: SS 2020	
	Intake capacity: 30	

Frequency and Duration: SS, 1 Semester

Module Coordinator: Chair of Agricultural, Food and Environmental Policy

Applies to the Study Programmes: Profil, Master (1.-4.); Profil englisch, Master (1.-4.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- have in-depth knowledge of the discussed subject
- know the theoretical basics of the field and know how to classify it
- are able to apply their knowledge of research results and research methods to selected scientific issues
- are capable to process advanced knowledge and to put it into practice

Module Content:
- Food safety
- Nutrition and health
- Animal welfare
- Environmental sustainability and organic farming
- Agrobiotechnology
- Digitalisation and innovation

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	30	60
Seminar		
Practical training	30	60
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Written examination and seminar paper (15-25 pages) or oral examination and seminar paper (15-25 pages) or oral examination
- Components of final grade: Written examination (50 %) and seminar paper (50 %) or oral examination (50 %) and seminar paper (50 %) or oral examination (100 %)
- Form of module retake examination: Written examination or oral examination

Language: English

MP-218-EN-DI	MP-218-EN-DI The Economics of Nitrate Pollution	6 CP
	The Economics of Nitrate Pollution	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agricultural Policy and Market Research	1.-4. Sem.;
	Offered for the first time: WS 2020/21	
	Intake capacity: 30	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Agricultural, Food and Environmental Policy

Applies to the Study Programmes: Profil englisch digital, Master (1.-4.); Profil, Master (1.-4.); Profil englisch, Master (1.-4.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- are able to identify, find and evaluate advanced literature on current topics, and to sum up and present the state of research;
- are able to participate in scientific discussions on the subject and to develop these further;
- are able to give their view on specific question critically and well-founded;

are able to prepare their advanced knowledge for a transfer into practice.

Module Content:
- Theoretical and methodological concepts for the economic analysis of nitrate pollution

Specific emphasis on the topic of nitrate pollution from the perspective of (1) environmental economics, (2) institutional economics, (3) behavioral economics, and (4) innovation economics

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture		
Seminar	30	60
Practical training	30	60
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Presentation (10-15 min.) and written assignment (15-25 pages) or seminar paper (15-25 pages) or oral examination and presentation (10-15 min.)
- Components of final grade: Presentation and written assignment (100 %) or seminar paper (100 %) or oral examination (50), presentation (50 %)
- Form of module retake examination: Revision of the written assignment or revision of the seminar paper within four weeks or oral examination

Language: English

MP-220-EN-DI	MP-220-EN-DI Special Topics of the UN Sustainable Development Goals I	6 CP
	Special Topics of the UN Sustainable Development Goals I	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agricultural Policy and Market Research	1.-4. Sem.;
	Offered for the first time: WS 2022/23	
	Intake capacity: 30	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Agricultural and Food Market Analysis

Applies to the Study Programmes: Profil englisch, Master (1.-4.); Profil englisch digital, Master (1.-4.); Profil, Master (1.-4.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- have in-depth knowledge of the discussed subject;
- know the theoretical basics of the field and important empirical applications;
- are able to apply their knowledge of research methods to selected scientific issues;
- are capable to conduct their own project work.

Module Content:
- Current topics of the research field

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	30	60
Seminar	30	60
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Assignments and project work or oral examination and project work or oral examination
- Components of final grade: Written assignments (50 %) and project work (50 %) or oral examination (50 %) and project work (50 %) or oral examination (100 %)
- Form of module retake examination: Written assignments or oral examination

Language: English

MP-221-EN-DI	MP-221-EN-DI Special Topics of the UN Sustainable Development Goals II	6 CP
	Special Topics of the UN Sustainable Development Goals II	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agricultural Policy and Market Research	1.-4. Sem.;
	Offered for the first time: WS 2022/23	
	Intake capacity: 30	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Agricultural and Food Market Analysis

Applies to the Study Programmes: Profil englisch digital, Master (1.-4.); Profil englisch, Master (1.-4.); Profil, Master (1.-4.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- have in-depth knowledge of the discussed subject;
- know the theoretical basics of the field and important empirical applications;
- are able to apply their knowledge of research methods to selected scientific issues;
- are capable to conduct their own project work.

Module Content:
- Current topics of the research field

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	30	60
Seminar	30	60
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Assignments and project work or oral examination and project work or oral examination
- Components of final grade: Written assignments (50 %) and project work (50 %) or oral examination (50 %) and project work (50 %) or oral examination (100 %)
- Form of module retake examination: Written assignments or oral examination

Language: English

MP-222-EN	MP-222-EN Introduction to International Trade	6 CP
	Introduction to International Trade	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agricultural Policy and Market Research	1.-4. Sem.;
	Offered for the first time: SS 2021	
	Intake capacity: not limited	

Frequency and Duration: SS, 1 Semester

Module Coordinator: Chair of Agricultural, Food and Environmental Policy

Applies to the Study Programmes: Profil GT, WW, Master (1.-4.); Profil, Master (1.-4.); Profil englisch, Master (1.-4.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- will understand the relevance of international trade with its different facets for our world
- will understand drivers, mechanisms and effects of international trade
- will understand the distributional and welfare effects of trade policy
- will understand how they can critically judge policy news with expert their knowledge

Module Content:
- the world economy: historical developments and descriptive statistics of international trade
- main exporters, importers and traded goods; the role of developing countries and agricultural goods
- basic models of international trade and graphical trade policy analysis
- foreign direct investments, technological progress, environmental effects and the ideas of advanced trade models

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	48	72
Seminar		
Practical training		
Exercises	12	48
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Written examination or assignments (4-8) or oral examination
- Components of final grade: Written examination (100 %) or assignments (100 %) or oral examination (100 %)
- Form of module retake examination: Written examination or assignments (4-8) or oral examination

Language: English

MP-227-EN	MP-227-EN Biodiversity Monitoring with Molecular Tools	6 CP
	Biodiversity Monitoring with Molecular Tools	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology	1.-4. Sem.;
	Offered for the first time: SS 2021	
	Intake capacity: 30	

Frequency and Duration: SS, 1 Semester

Module Coordinator:

Applies to the Study Programmes: Profil englisch, Master (1.-4.); Profil, Master (1.-4.);

Prerequisites for Participation: None (recommended: basic understanding of laboratory methods in molecular ecology, basic knowledge of R)

Learning Outcomes:
The students
- understand the main genomic approaches for evaluating biodiversity loss;
- can design and evaluate a simple DNA-based community ecology experiment.

Module Content:
- main causes and history of Anthropocene biodiversity loss
- relevant genomic approaches for evaluating biodiversity loss
- experimental design
- sampling and processing DNA
- bioinformatics and statistics of high-throughput DNA sequence data
- interpretation of results

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	10	40
Seminar	5	20
Practical training	45	60
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Presentation (10 - 15 min) and protocol (up to 10 pages excluding references and appendix)
- Components of final grade: Presentation (30%) and protocol (70%)
- Form of module retake examination: Revision of presentation or protocol, or oral exam

Language: English

<table>
<tr><td rowspan="2">MP-230-EN-DI</td><td>MP-230-EN-DI Sustainable Plant Protection</td><td rowspan="2">6 CP</td></tr>
<tr><td>Sustainable Plant Protection</td></tr>
<tr><td rowspan="3">Optional Module</td><td>Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology</td><td rowspan="3">1.-4. Sem.;</td></tr>
<tr><td>Offered for the first time: WS 2022/23</td></tr>
<tr><td>Intake capacity: 30</td></tr>
<tr><td colspan="3">Frequency and Duration: WS, 1 Semester</td></tr>
<tr><td colspan="3">Module Coordinator: Chair of Applied Entomology</td></tr>
<tr><td colspan="3">Applies to the Study Programmes: Profil englisch digital, Master (1.-4.); Profil, Master (1.-4.); Profil englisch, Master (1.-4.);</td></tr>
<tr><td colspan="3">Prerequisites for Participation: None (recommended: basic knowledge in Organic Chemistry, Entomology, Molecular Biology, Microbiology, and Mycology)</td></tr>
<tr><td colspan="3">Learning Outcomes:
gain a comprehensive overview of the theoretical background and practical approaches of modern, sustainable plant protection;
will be able to work in the field of plant protection in agri- and horticulture, in agrochemical and biotechnological industry, for regulation authorities, and in in plant health service.</td></tr>
<tr><td colspan="3">Module Content:
General aspects and history of plant protection
Past, present, and future of the major classes of pesticides used for chemical control of plant diseases (Fungicides, Herbicides, Insecticides, acaricides, and nematicides)
Impact of agriculture on biodiversity and insect decline
Screening for new plant-protective compounds
Invertebrates (beneficial insects and other arthropods, entomopathogenic nematodes)
Biotechnological approaches – Semiochemicals (pheromones and allelochemicals)
Entomopathogenic bacteria, viruses, and fungi
Precision Agriculture approaches
RNAi approaches
Tools for genome editing
GMO’s
Restoring biodiversity in agricultural landscapes</td></tr>
</table>

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	36	72
Seminar	24	48
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Oral examination
- Components of final grade: Oral examination (100 %)
- Form of module retake examination: Oral examination

Language: English

MP-234-EN	MP-234-EN Crop Abiotic Stresses	6 CP
	Crop Abiotic Stresses	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding I	1.-4. Sem.;
	Offered for the first time: SS 2022	
	Intake capacity: 30	

Frequency and Duration: SS, 1 Semester

Module Coordinator: Chair of Agronomy and Crop Physiology

Applies to the Study Programmes: Profil, Master (1.-4.); Profil englisch, Master (1.-4.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- are able to understand the cause of abiotic stresses occurring in crops production;
- know how to design experiments to evaluate the performance of different genotypes under specific stress conditions;
- know how to monitor plant physiological parameters including photosynthesis, leaf spectral reflectance and development;
- are able to conduct physiological and biochemical analyses on plant samples in the lab;
- are able to perform statistical analyses on the data from screening experiments to understand the effects of treatment, genotype and treatment by genotype interaction;
- know how to design scientific posters and write reports for presenting research results.

Module Content:
- Responses to abiotic stressesIn of rice and maize
- different types of abiotic stresses (drought, submergence, salinity, iron toxicity and cold)
- screening experiments under the stress conditions
- phenotyping devices to evaluate the performance of plants under optimal and stress conditions
- physiological and biochemical analyses

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture		
Seminar	10	20
Practical training	30	60
Exercises	20	40
Excursion		
Total:	180	

Prerequitistes for Examination: Attendance rate of the practical activities must be more than 90%.

Module Examination:
- Form(s) of assessment: Poster with presentation (max. 10 minutes) and seminar paper (8-12 pages)
- Components of final grade: Poster with presentation (50 %), seminar paper (50 %)
- Form of module retake examination: Revision of the seminar paper

Language: English

MP-235-EN	MP-235-EN Practical Genome Sequencing and Bioinformatics	6 CP
	Practical Genome Sequencing and Bioinformatics	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding I	1.-4. Sem.;
	Offered for the first time: SS 2022	
	Intake capacity: 30	

Frequency and Duration: SS, 1 Semester

Module Coordinator: Chair of Agrobioinformatics

Applies to the Study Programmes: Profil, Master (1.-4.); Profil englisch, Master (1.-4.);

Prerequisites for Participation: Biotechnology and Genomics (MK-016-EN)

Learning Outcomes:
The students
- are familiar with practical experimental techniques related to genome sequencing and genomic data analysis;
- know how to extract plant DNA samples and check DNA quality using standard molecular biology techniques;
- know the principles for generating DNA libraries suitable for high-throughput DANN sequencing;
- know how analyse resulting genomic data using bioinformatics methodologies;
- are familiar with the Linux operating system and high performance computing necessary for bioinformatics analysis;
- know the principles of scientific record keeping and lab reporting based on the experiments performed.

Module Content:
- DNA extraction
- DNA quantification using RT-PCR
- Library preparation
- High-throughput DNA sequencing
- Bioinformatics analysis of sequencing data
- Molecular biology quality control techniques (PCR, gel electrophoresis, etc)
- Production of lab books and practical reports

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	10	20
Seminar		
Practical training	50	100
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: Participation in laboratory classes

Module Examination:
- Form(s) of assessment: Seminar paper (3000 words minimum) and lab book (4 to 6 experiments)
- Components of final grade: Seminar paper (60 %), lab book (40 %)
- Form of module retake examination: Revision of seminar paper and lab book

Language: English

MP-236-EN	MP-236-EN Quantitative Genetics	6 CP
	Quantitative Genetics	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding II	1.-4. Sem.;
	Offered for the first time: SS 2022	
	Intake capacity: not limited	

Frequency and Duration: SS, 1 Semester

Module Coordinator: Chair of Biometry and Population Genetics

Applies to the Study Programmes: Profil englisch, Master (1.-4.); Profil, Master (1.-4.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- know quantitative genetic models to decompose the genotypic value;
- understand the basics of quantitative inheritance and genome-wide prediction;
- understand models of selection theory;
- can estimate the expected response to selection.

Module Content:
- Additive, dominance, and epistasic effects
- Performance prediction of selection candidates
- Estimation of variance components and heritability
- Direct selection, indirect selection, multistage selection, index selection

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	30	60
Seminar		
Practical training	30	60
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:
- Form(s) of assessment: Assignments (4) or written examination
- Components of final grade: Assignments (100 %) or written examination (100%)
- Form of module retake examination: Written examination

Language: English

MP-246-EN	MP-246-EN Transition to a Sustainable Bioeconomy	6 CP
	Transition to a Sustainable Bioeconomy	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding I	1.-4. Sem.;
	Offered for the first time: WS 2022/23	
	Intake capacity: not limited	

Frequency and Duration: WS, 1 Semester

Module Coordinator:

Applies to the Study Programmes: Profil, Master (1.-4.); Profil englisch, Master (1.-4.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- have knowledge of origin and evolution of the Bioeconomy;
- have insight into genetic and environmental factors influencing primary production in agricultural crops;
- have an overview of Knowledge base for biobased value chains;
- have an appreciation of Bioeconomy strategies and Policies.

Module Content:
- History and development of bioeconomy: Policies and progress in different countries
- Overview of crop types: annual v perennial, C3 v C4
- Biomass yield: potential, attainable and actual with crop modelling
- Biomass utilisation cascades: actual and potential
- Recent projects running in different countries
- Sustainability criteria, life cycle assessment

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	20	
Seminar	10	
Practical training	4	
Exercises		
Excursion	12	
Total:	46	

Prerequitistes for Examination:

Module Examination:
- Form(s) of assessment:
- Components of final grade:
- Form of module retake examination:

Language: English

MP-248-EN	MP-248-EN Fruit Breeding	6 CP
	Fruit Breeding	
Optional Module	Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding II	1.-4. Sem.;
	Offered for the first time: WS 2022/23	
	Intake capacity: 30	

Frequency and Duration: WS, 1 Semester

Module Coordinator: Chair of Biometry and Population Genetics

Applies to the Study Programmes: Profil, Master (1.-4.); Profil englisch, Master (1.-4.);

Prerequisites for Participation: None

Learning Outcomes:
The students
- have insight into the objectives and peculiarities of fruit breeding;
- have knowledge on the origin, evolution and domestication of the most important European fruit species;
- have broad application knowledge of processes of species specific breeding programs.

Module Content:
- History, economic significance and methods of fruit breeding
- Plant variety protection and marketing of plant material
- Phylogenetic origin of important fruit species
- The use of genetic resources for fruit breeding
- State of the art fruit breeding technologies
- Fruit breeding explained with selected examples

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture	36	72
Seminar	6	12
Practical training	6	12
Exercises	4	8
Excursion	8	16
Total:	180	

Prerequitistes for Examination: Written assignement (protocol and questionnaire, 4 pages within 2 weeks)

Module Examination:
- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100 %)
- Form of module retake examination: Written examination

Language: English

<table>
<tr><td rowspan="2">MP-252-EN-DI</td><td>MP-252-EN-DI Sustainable Water Management</td><td rowspan="2">6 CP</td></tr>
<tr><td>Sustainable Water Management</td></tr>
<tr><td rowspan="3">Optional Module</td><td>Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agricultural Policy and Market Research</td><td rowspan="3">1.-4. Sem.;</td></tr>
<tr><td>Offered for the first time: WS 2023/24</td></tr>
<tr><td>Intake capacity: 30</td></tr>
<tr><td colspan="3">Frequency and Duration: WS, 1 Semester</td></tr>
<tr><td colspan="3">Module Coordinator: Chair of Agricultural, Food and Environmental Policy</td></tr>
<tr><td colspan="3">Applies to the Study Programmes: Profil, Master (1.-4.); Profil englisch, Master (1.-4.);</td></tr>
<tr><td colspan="3">Prerequisites for Participation: None</td></tr>
<tr><td colspan="3">Learning Outcomes:
The students
• are able to identify and evaluate advanced literature on current (research?) topics and summarize and present the current state of research;
• are able to get involved in scientific discussions and develop them further;
• are able to make a critical and well-founded statement on specific topics and can develop them further.</td></tr>
<tr><td colspan="3">Module Content:
• Water Resources, Water Governance and Management
• Water Security: from Concept to Reality
• Integrated Water Resources Management: Principles and Instruments
• Socio-Technical Aspects of Water Resources Management
• Water Management Under Uncertainty: Climate and Water
• Transboundary Water Resources Management
• Water Diplomacy
• Agenda 2030 And SDG 6 (Clean Water and Sanitation)
• SDG Interlinkages – Synergies & Tradeoffs</td></tr>
</table>

Forms of Instruction:	Contact hours	Preparation and follow-up work
Lecture		
Seminar	60	120
Practical training		
Exercises		
Excursion		
Total:	180	

Prerequitistes for Examination: None

Module Examination:

- Form(s) of assessment: Presentation (15–20 Min.) with written assignment (5–7 pages) or seminar paper (15–20 pages) or written examination and presentation (15–20 Min.)
- Components of final grade: Presentation (50 %) with written assignment (50 %) or seminar paper (100 %) or written examination (50 %) and presentation (50 %)
- Form of module retake examination: Revision of the written assignment or revision of the seminar paper or oral exam

Language: English