UNIVERSITÄT HOHENHEIM

Modulhandbuch

für den Studiengang Master of Science Food Systems

Stand Oktober 2020

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Module: Advanced Flavor Chemistry (1508-410)

Module supervisor	Yanyan Zhang
Relation to other modules	-
Prerequisites for attendance	Scientific background in chemistry and biotechnology
Teaching language	English
ECTS	7,5
Frequency of offer	every SS
Module duration	4 weeks (block 1)
Degree programs	Food Biotechnology (Master, since 01.10.2016) 2. Semester, elective Food Science and Engineering (Master, since 01.10.2013) 2. Semester, elective Food Systems (Master, since 01.10.2019) 2. Semester, elective
Length of the examination	120 minutes
Class attendance	60h
Self studying	165h
Amount of work	225h workload
Professional competences	This course will offer students the knowledge on flavour legislation, flavour analysis, aroma retention & release, flavour generation, flavour biotechnology, and the roles of flavour compounds on food process & storage. The students: • know the various analytical measurements of flavour compounds, correlated instrument and data analysis • arrange instrumental analyse and sensory evaluation on flavor compounds of food and drink using the proper methods and equipment • be familiar with presenting their work through written reports and oral presentations.
Comments	-
Module examination	Written exam (80%), seminar (20%), practical course (passed)
Course achievement	Participation in lecture, seminar (presentation & report), and practice course (protocol)
Advanced Flavor Chemistry (1508-411)	
Person(s) responsible	Yanyan Zhang
Type of element	lecture with exercise course
Hours per week	5

Contents	Lecture: Basic information on flavor property, individual aroma compounds and corresponding non-enzymatic or enzymatic pathways, flavor biotechnology, principles of analytical instruments involved in aroma analysis, sources of off-flavor compounds in raw materials, food processing and storage. Lab exercise: Perceiving and distinguishing the different odorants by sniffin sticks & Gas chromatography-olfactometry (GC-O) & data analysis of MS fragmentation & semi-quantification of odourants & bioflavor generation by submerged cultivation of edible basidiomycetes
Literature	Belitz, H.D., Grosch, W. Schieberle, P.: Food Chemistry. Springer, 2009 Berger, R.G.: Flavours and Fragrances. Springer, 2007
Comments	-
Advanced Flavor Chemistry (1508-412)	
Person(s) responsible	Yanyan Zhang
Type of element	seminar
Hours per week	1
Contents	Evaluation of publications and research contributions. Conclusion of scientific literature, presenting and discussing on topic on flavour chemistry and biotechnology.
Literature	-
Comments	-

Module: Advanced Food Bioanalysis (Belfast 2)

Module supervisor	Prof. Katrina Campbell
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every SS
Module duration	1 semester
Degree programs	Food Systems (Master, since 01.10.2019) 2. Semester, semi-elective
Length of the examination	continuous assessment
Class attendance	74 h attendance
Self studying	151 h independent study
Amount of work	225 h workload
Professional competences	**Learning outcomes** Upon successful completion of this module students should be able to: • Collate data obtained from a range of analytical techniques and communicate this information in a meaningful format to facilitate the assessment of findings. • Critically evaluate different forms of testing and apply this knowledge in food related applications. **Skills:** Transferability/Employability: Oral and written communication; time keeping and awareness of laboratory health and safety; completing analysis of acquired data; reporting of experimental findings in appropriate format for interpretation; obtaining information and comparing findings from published literature; task management within group working situations. Subject specific increased knowledge and practical skills in key aspects of food safety analysis. Cognitive skills: apply acquired

	knowledge to solve practical problems and relate theory to practice.
Comments	-
Module examination	Lab report (60%) + Essay (40%)
Course achievement	-
Contents	Principles behind new emerging screening technologies for rapid/early detection of feed/food contamination incidents and farm animal diseases. Overviews of applications of various test platforms to include Time of Flight mass spectrometry, biosensor-based technologies, spectrometric approaches and ELISA's in food safety analysis will be delivered and complemented by hands-on practical experience in the use of relevant instrumentation.
Type of event	Lecture with practical unit

Module: Advanced Meat Science and Technology (1507-500)

Module supervisor	Jochen Weiss
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every WS
Module duration	4 weeks (block 1)
Degree programs	Food Science and Engineering (Master, since 01.10.2013) 3. Semester, elective Food Microbiology and Biotechnology (Master, since 01.10.2013) 3. Semester, elective Food Biotechnology (Master, since 01.10.2016) 3. Semester, elective Food Systems (Master, since 01.10.2019) 1. Semester, elective
Length of the examination	120 minutes
Class attendance	60h
Self studying	165h
Amount of work	225 h workload
Professional competences	The aim of the course is that after completion of the course, students are able to recall knowledge of fundamental biochemical properties of animal-based raw materials. They understand various industrial processes used to convert these specific raw materials into various meat products. They generate self-reliantly the most popular and commonly manufactured meat products in teamwork. They perform the required process operaions on a pilot plant scale to generate those products. They know and recognize the function and role of various additives and ingredients used to manufacture industrial meat products. They analyze and calculate the most important quality parameters for meat and meat products and know the legal framework. The students restructure raw material and technological elements according to a specific task into new products. They understand scale up issues and topics surrounding hygiene and safety of meat-based products. The aim of the course is that after completion of the course, students are able to have advanced knowledge in key unit operations. Participants apply

	critical problem assessments and discriminate tasks and targets with analytical thinking. They evaluate the results for evaluation of known quality criteria. They develop their creative potential, their ability to communicate and cooperate in teamwork. They represent scientific results in an appropriate manner and improve their verbal skills.
Comments	Maximum number of participants: 24 Registration via Ilias 150 g Registration opens 4 weeks prior to the start of the semester Criteria according to which study places are awarded: in order of receipt
Module examination	written exam, oral presentation Written exam 80% and oral presentation 20%
Course achievement	oral presentation
Advanced Meat Science and Technology (1507-501)	
Person(s) responsible	Jochen Weiss Kurt Herrmann Monika Gibis
Type of element	lecture
Hours per week	4
Contents	A focus of the course is to introduce students to modern industrial processes used to generate the most popular and commonly manufactured meat products, i.e. boiled, cooked or raw, fermented sausages and cooked or raw hams. Students will learn about the properties of raw materials used and issues surrounding their provisioning (e.g. slaughtering, cutting, conditioning or confectioning). The course features various guest speakers from industry that will introduce students to specific aspects of this industrial sector (e.g. encasing of products, smoking and drying of products, use of starter cultures). The course will allow an insight into key analytical methods that are required to comply with regulatory aspects of the meat products, such as method to analyze meat product quality and safety.
Literature	Script to the module
Comments	Registration opens 4 weeks prior to the start of the semester and closes at the begin-ning of the semester. First preference will be given to students enrolled in the M.Sc. Food Science and Engineering and then M.Sc. Food Biotechnology. Remaining free slots will then be given to students enrolled in other M.Sc. degree programs.
Advanced Meat Science and Technology (1507-502)	
Person(s) responsible	Jochen Weiss Kurt Herrmann Monika Gibis

Type of element	internship
Hours per week	2
Contents	A focus of the course is to introduce students to modern industrial processes used to generate the most popular and commonly manufactured meat products, i.e. boiled, cooked or raw, fermented sausages and cooked or raw hams. Students will participate in daily pilot plant exercises where they will have the opportunity to manufacture boiled, cooked or raw, fermented sausages and cooked or raw hams products themselves. The course will allow an insight into key analytical methods and will analyze the most important analytical methods for meat products that are required to comply with regulatory aspects of the meat products. They will present their group exercise in a presentation.
Literature	Script to the module
Comments	Registration opens 4 weeks prior to the start of the semester and closes at the beginning of the semester. First preference will be given to students enrolled in the M.Sc. Food Science and Engineering and then M.Sc. Food Biotechnology. Remaining free slots will then be given to students enrolled in other M.Sc. degree programs.
Advanced Meat Science and Technology (1507-503)	
Person(s) responsible	Jochen Weiss Kurt Herrmann Monika Gibis
Type of element	excursion
Hours per week	1
Contents	The participants of the module will have the opportunity to visit one or more industrial meat product manufacturing facilities.
Literature	Script to the module
Comments	Depending on availability of industrial partners, this part of the course might be transformed into another learning material.

Module: Advanced Process Engineering Techniques for Cereal Processing (1509-500)

Module supervisor	Bernd Hitzmann
Relation to other modules	-
Prerequisites for attendance	English language skills
Teaching language	English
ECTS	7,5
Frequency of offer	every SS
Module duration	4 weeks (block 2)
Degree programs	Food Science and Engineering (Master, since 01.10.2013) 2. Semester, elective Food Microbiology and Biotechnology (Master, since 01.10.2013) 2. Semester, elective Food Biotechnology (Master, since 01.10.2016) 2. Semester, elective Food Systems (Master, since 01.10.2019) 2. Semester, elective
Length of the examination	60 minutes
Class attendance	-
Self studying	-
Amount of work	56 h attendance + 132 h independent study = 188 h workload
Professional competences	In the module advanced techniques and methods of the processing of cereals on their way to food will be presented. Process measurement, analysis, evaluation as well as optimization techniques will be discussed. After the module the participant knows: - Fundamentals of advanced process engineering techniques - The diversity of cereals as raw material - Milling, fermenting and baking techniques - Functional ingredients - Molecular reactions that occur during cereal processing, The advanced process analytics and monitoring methods (like NIR-, fluorescence spectroscopy, image analysis), Different kinds of models to describe important processing steps, Process optimization procedures.
Comments	-
Module examination	a written exam
Course achievement	Passing the practical course

Advanced Process Engineering Techniques for Cereal Processing (1509-501)

Person(s) responsible	Bernd Hitzmann
Type of element	lecture with excursion and lab hours

Hours per week	4
Contents	In the module advanced techniques and methods of the processing of cereals on their way to food will be presented. The topics are : -Process analysis technology of cereal processing, -Breeding and growing aspects, -Storage, cleaning and milling techniques, -Cereal products, -Functional ingredients and molecular reactions, -NIR-, fluorescence, image analysis, -Mixing, kneading, proving, baking techniques -Modeling techniques of processing steps
Literature	Burns, D.A.; Ciurczak, E.W.: Handbook of Near-Infrared Analysis, CRC Press, Boca Raton, 2008; Cauvain, S.P.: Bread making, Woodhead Publishing Limited, Cambridge 2003; Gobbetti, M.; Gänzle, M. (Eds.): Handbook on Sourdough Biotechnology, Springer, New York, 2013; MacRitchie, F.: Concepts in Cereal Chemistry, CRC Press, Boca Raton, 2010
Comments	-

Module: AgFoodTech (1507-450)

Module supervisor	Jochen Weiss
Relation to other modules	The module is taught directly following the introductory SPOC, which introduces students to the food system. In the module, students focus on the AgriFood subsegment of this system, from the combined perspectives of agrarian technology and food science. The module enables them to take a systemic-integrative perspective on this subsegment of the Food System. This perspective will be further enriched and fleshed out in two further modules chosen from the pool of electives.
Prerequisites for attendance	Before starting this module, the “SPOC: Introduction to Food System” module has to be completed successfully
Teaching language	English
ECTS	7,5
Frequency of offer	every semester
Module duration	1 semester
Degree programs	Food Systems (Master, since 01.10.2019) 1. Semester, compulsory
Length of the examination	90 minutes
Class attendance	56h
Self studying	169h
Amount of work	225 h workload
Professional competences	- Students can organize individual field, post-harvest, and food processing technologies into sequential transformation chains - Students can appraise the functionalities of sequential transformation chains - Students can investigate and quantitatively assess key process outcomes of select chains based on given input parameters (e.g. energy, mass, properties of raw materials etc.) - Students can classify and explain key agriculture and food technologies that transform raw material into value added foods - Students can define the role of AgFoodTech in the food system - Making value judgments and sustainability competencies - Creativity skills and competencies - Research skills and competencies - Intellectual transforming skills and competencies
Comments	Sign-up for module: in ILIAS

	The lectures of this course might be held online. Maximum of participants 15.
Module examination	written exam written exam
Course achievement	-
AgFoodTech (1507-451)	
Person(s) responsible	Jochen Weiss
Type of element	lecture with exercise course, lab hours and excursion
Hours per week	4
Contents	AgriFood Science and Engineering combines knowledge and skill from the fields of agrarian technology and food processing.
Literature	-
Comments	Pls. Note, this module is intended for first semester Master of Food Systems students, and includes laboratories and practical exercises in fulfillment of the requirement for their degree. Preference will be given to them, but remaining spaces may be taken by for example incoming guest students of other semesters in the Master degree of Food Systems. For national or international students not able to attend live lectures, or students that want to get the theoretical background but are unable to sign up for this course due to capacity limitations, pls. select the course AgFoodTech Lecture Series instead.

Module: Agricultural Production of Biobased Resources (3403-430)

Module supervisor	Iris Lewandowski
Relation to other modules	This module provides the basic knowledge on agricultural production of biobased resources that is needed to accomplish the Master Programme in Bioeconomy.
Prerequisites for attendance	See admission regulations for the Master Programme Bioeconomy.
Teaching language	English
ECTS	6
Frequency of offer	every WS
Module duration	1 semester
Degree programs	Biobased Products and Bioenergy (Master, since 01.10.2019) 3. Semester, elective Biobased Products and Bioenergy (Master, since 01.04.2019) 3. Semester, elective Bioeconomy (Master, since 01.10.2014) 1. Semester, semi-elective Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 1. Semester, semi-elective
Length of the examination	60 minutes
Class attendance	-
Self studying	-
Amount of work	56 h presence + 124 h preparation at home = 180 h workload
Professional competences	Students have a sound knowledge of crop and livestock production in various agro-ecological zones and production systems. They are able to understand the conditions of agricultural production for biomass under different ecological and socio-economic settings. They investigate the natural resource base of agricultural production and have the skills to characterize material flows in agricultural systems, including agricultural products. On this basis, they are able to develop concepts for the sustainable production of biomass for the biobased economy. Students are able to deal with complex natural systems. They understand the implications of this complexity on the agricultural production stage of biobased value chains. They gain the analytical skills and practice the critical thinking necessary to engage in the discussion on sustainable land-use systems

	and the implications of competing uses of biomass on food security. They are able to explain the role of agricultural production in the bioeconomy. They also gain skills in oral presentation, team work and interdisciplinary collaboration.
Comments	Maximum number of participants (due to limited number of places on excursion): 45 Prioritiy will be given to students for whom the module is compulsory.
Module examination	50% written exam, 50% presentation including discussion
Course achievement	All students prepare and hold a presentation (50%)
Agricultural Production of Biobased Resources (3403-431)	
Person(s) responsible	Iris Lewandowski Regina Birner Uta Dickhöfer
Type of element	lecture
Hours per week	4
Contents	The overall objective of the module is to provide fundamental knowledge on the functioning of agricultural systems in different climatic zones for the production of biobased resources for the bioeconomy. Contents of the module include: º Description, systematics and functioning of agro-ecosystems; º Provision of ecosystem services; º Bio-physical principles of agricultural production; º Role of climate in agricultural production and impact of climate change. º Systematics, description and analysis of agricultural production systems in different agro-ecological regions; º Case studies in crop and animal production; º In- and outputs and material flows in agricultural production systems; º Yields and quality of products from agricultural production; º Biomass supply systems; º Logistic aspects of biomass supply; º Biomass supply in the context of food security.
Literature	to be announced

Comments	-

Module: Agri-Food Traceability and Fraud (Belfast 1)

Module supervisor	Prof Andy Meharg
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every SS
Module duration	1 semester
Degree programs	Food Systems (Master, since 01.10.2019) 2. Semester, semi-elective
Length of the examination	continuous assessment
Class attendance	71 h attendance
Self studying	154 h independent study
Amount of work	225 h workload
Professional competences	**Learning outcomes** Upon successful completion of the module students should be able to: • demonstrate knowledge of the various forms of food fraud prevalent at a local and global level; • assess potential impacts which incidents related to intentional and unintentional compromising of food chain integrity have on consumer confidence and food company survival; • identify ways to mitigate against and monitor for compromised food integrity **Skills:** Transferability/Employability: Oral and written communication; obtaining information and comparing findings from published literature; task management within group working situations. Subject specific: Increased knowledge and appreciation of key outcomes related to incidents of compromised food integrity and associated economic consequences.

Comments	-
Module examination	Report (60%) + Essay (25%)
Course achievement	-
Contents	Examples of highly varied, internationally relevant and difficult to detect incidences of food fraud and compromised food traceability will be examined. The range and types of food fraud will be discussed and the means of detecting such incidences to ensure that food is safe, wholesome and authentic demonstrated. Regulatory requirements and associated challenges to the maintenance of food quality/safety will be elucidated highlighting the need for sensitive analytical techniques which can assist in such tasks. The economic consequences of food product recalls due to food contamination incidents will be assessed highlighting the need for traceability across the whole food supply chain, together with an exploration of consumer willingness to pay for improvements to aspects of food safety and traceability.
Type of event	Lecture with practical unit

Module: Computational Biology (1911-400)

Module supervisor	Dr. Michael Altenbuchinger
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every SS
Module duration	4 Wochen (Block 4)
Degree programs	M.Sc. Biologie (PO vom: 21.06.2010) - ab Studienbeginn WiSe 2014/2015, 2. Semester; Wahlpflicht M.Ed. Lehramt Biologie (PO vom: 01.10.2017), 4. Semester; Wahl M.Ed. Erweiterungsamster Biologie Lehramt (PO vom: 01.10.2017), 4. Semester; Wahl M.Sc. Molekulare Ernährungswissenschaft (PO vom: 21.06.2010), 2./4. Semester; Wahl M.Sc. Ernährungsmedizin (PO vom: 21.06.2010), 2./4. Semester; Wahl M.Sc. Food Biotechnology (PO vom: 17.07.2013) - ab Studienbeginn WiSe 2016/2017, 2./4. Semester; Wahl M.Sc. Food Science and Engineering (PO vom: 17.07.2013), 2./4. Semester; Wahl M.Sc. Lebenmsittelchemie (PO vom: 13.02.2015), 4. Semester; Wahl M.Sc. Food Systems (PO vom: 12.02.2019), 2./4. Semester; Wahl M.Sc. Agrarbiologie (ab WS 20/21), 2. Semester; Wahlpflicht Promotionsstudiengang Naturwissenschaften (PO vom 14.02.2015), 1./2. Semester; Wahl
Length of the examination	30-45 Minuten
Class attendance	-
Self studying	-
Amount of work	56 h Präsenzzeit + 169 h Eigenanteil = 225 h Arbeitsaufwand
Professional competences	This Module should qualify students to deal with biological high-throughput data, to assess their quality, and to understand and apply essential statistical and algorithmic methods for their analysis.

	After finishing this module, the students should be able to work independently and self-reflective, and to see and communicate abstract relationships.
Comments	Number of participants: 25 Registration via ILIAS necessary (first-come, first-serve)
Module examination	Mündliche Prüfung
Course achievement	-
Computational Biology (1911-401)	
Person(s) responsible	
Type of element	lecture with exercise course
Hours per week	4
Contents	This course will cover an overview of key topics in computational biology, such as the analysis of gene expression data, genome alignment and assembly, genome interpretation, genomic networks, and phylogenetics. The course will review basic statistical terms and concepts, such as probability distributions, significance tests, and multivariate data analysis. Computational strategies that will be addressed are hidden Markov models, machine learning techniques for dimension reduction, clustering and classification.
Literature	Susan Holmes, Wolfgang Huber, "Modern Statistics for Modern Biology", Cambridge University Press, 2018 Florian Markowetz, "All biology is computational biology", https://doi.org/10.1371/journal.pbio.2002050, 2017 Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, "An Introduction to Statistical Learning", http://faculty.marshall.usc.edu/gareth-james/ISL/ISLR%20Seventh%20Printing.pdf
Comments	Programmierkenntnisse in einer beliebigen Programmiersprache, z.B. in R oder Python, werden vorausgesetzt.

Module: Dairy Science and Technology (1505-440)

Module supervisor	Jörg Hinrichs
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every SS
Module duration	4 weeks (block 2)
Degree programs	Food Microbiology and Biotechnology (Master, since 01.10.2013) 2. Semester, elective Food Science and Engineering (Master, since 01.10.2013) 2. Semester, elective Food Biotechnology (Master, since 01.10.2016) 2. Semester, elective Food Systems (Master, since 01.10.2019) 2. Semester, elective
Length of the examination	120 minutes
Class attendance	-
Self studying	-
Amount of work	70 h attendance + 108 h independent study = 188 h workload
Professional competences	The aim of the course is to learn about the physical and chemical properties of milk ingredients and their processing characteristics. The relationships between raw material processing technology and product characteristics are introduced. It also teaches the concept of mass and energy balances, the estimation of the microbial risk of dairy products and the hazards associated with the various processing steps. The students develop their ability to work independently through practical work. At the same time, they are expected to work in teams for some exercises. They also gain problem solving skills in these tasks.
Comments	Maximum number of participants: 25
Module examination	Exam (70 % of total), practical seminar (30% of total) Written (120 minutes) or oral (20 minutes) exam
Course achievement	-
Dairy Science and Technology (1505-441)	
Person(s) responsible	Jörg Hinrichs
Type of element	lecture with exercise course and lab hours
Hours per week	5

Contents	- Physics and chemistry of milk components -Analytical tools - Hygiene and aseptic - Evaporation to milk concentrate - Membrane filtration to fractionate milk - Milk powder production tehnology & application aspects - Milk desserts and foams
Literature	Kessler, H.G., Food & Bio Process Engineering – Dairy Technology, A. Kessler, München, 2011. Hinrichs, J., Lecture notes Palzer, S., Lecture notes
Comments	A one-day excursion is part of this module.

Module: Drying, Granulation and Instantisation (1503-540)

Module supervisor	Reinhard Kohlus
Relation to other modules	-
Prerequisites for attendance	Knowledge of equivalent to Food Process Design I, e.g. Basics of fluid mechanics, mass and heat transfer, unit operations in food processing.
Teaching language	English
ECTS	7,5
Frequency of offer	every SS
Module duration	4 weeks (block 4)
Degree programs	Food Science and Engineering (Master, since 01.10.2013) 2. Semester, elective Food Microbiology and Biotechnology (Master, since 01.10.2013) 2. Semester, elective Food Biotechnology (Master, since 01.10.2016) 2. Semester, elective Food Systems (Master, since 01.10.2019) 2. Semester, elective
Length of the examination	-
Class attendance	-
Self studying	-
Amount of work	56 h attendance + 154 h independent study = 210 h workload
Professional competences	The students will learn to model drying problems. Starting at the physical basics of drying up to equipment design. They know key quality parameter and degradation mechanism for dry / low aw food. The learned skills focus on applicable knowledge which is based on strong basic / theoretical foundations allowing to apply it in a wide context. The application of computer based methods is trained by working on application case studies. Key competencies addressed in this module are critical problem assessment and analytical thinking.
Comments	Maximum number of participants: 20 Registration via ILIAS until 2 weeks before the course starts.
Module examination	Written exam (60 minutes), oral exam (30 minutes).
Course achievement	-

Drying, Granulation and Instantisation, Lecture (1503-541)

Person(s) responsible	Reinhard Kohlus
Type of element	lecture with lab hours
Hours per week	4

Contents	Selection and lay out (dimensioning) of drying equipment for tasks in food processing. Scientific description of dryer, typical equipment used in food drying: i.e. spray dryer, belt drier, roller drier, freeze drier Analysis and modelling of temperature-moisture behaviour of foods. Fundamentals of Agglomeration / granulation. Design, Scale up and operation (Process lay out) of granulators and agglomerators (Fluid bed and High shear mixer). Computation of relevant problems related to dry food. Fundamental approach to problems in drying and dealing with low aw foods. Selected examples of recipe effects in drying and instantisation of food. Quality parameter of dry foods, interactions and storage effects. Characterisation, functionality and quality of food powders and related property functions, importance of amorphous state mechanism and parameter determining the quality of low aw food and their relation to the drying process.
Literature	Trocknungstechnik in der Lebensmittelindustrie , Gehrmann, Esper, Schuchmann, Behrs-Verlag 2009; Die wissenschaftlichen Grundlagen der Trocknungstechnik Band 1, , O. Krischer, W. Kast Springer Verlag 1992
Comments	List of English literature will be provided at start of course

Module: Emerging Technologies Business Case Study (1507-460)

Module supervisor	Jochen Weiss
Relation to other modules	The module „Emerging Technology Business Case Study“ is the 3rd of the overarching modules in the curriculum. In this module, students form international and cross-disciplinary teams. It builds on the learning outcomes of the Summer School, as well as knowledge and skills acquired in previous modules, enabling students to develop new and promising business cases for specific emerging technologies in the food sector.
Prerequisites for attendance	Before starting this module, the “SPOC: Introduction to Food System” module has to be completed successfully.rnrnThis module builds on knowledge and skills acquired in the modules „Introduction to the Food System” and “Summer School: Entrepreneurship and Innovation in Food Systems”.
Teaching language	English
ECTS	7,5
Frequency of offer	every WS
Module duration	1 semester
Degree programs	Food Systems (Master, since 01.10.2019) 3. Semester, compulsory
Length of the examination	20 minutes
Class attendance	-
Self studying	-
Amount of work	56 h attendance time + 169 h independent study = 225 h workload
Professional competences	Upon completion of this module, students will be able to: • Describe the business environment in the food sector • Perform due diligence analysis on a specific food sector idea • Articulate the market opportunity including a competitor analysis and industry assessment • Develop a commercialisation strategy • Pitch the strategy to potential investors Upon completion of this module, students will: • be able to translate innovations into feasible business solutions for the food sector • be able to think beyond boundaries and systematically explore and generate new ideas, responding to current and future challenges within the food system • be able to use knowledge, ideas and technology to create new or

	significantly improved products, services, processes, policies, new business models or jobs in the food sector. • Possess decision-making and leadership competencies, based on a holistic understanding of the contributions of Higher Education, research and business to value creation, in limited sized teams and contexts
Comments	-
Module examination	written report, presentation 60% Case Study + 40% Pitch
Course achievement	-
Emerging Technologies Business Case Study (1507-461)	
Person(s) responsible	Jochen Weiss
Type of element	course
Hours per week	-
Contents	- Intellectual Property protection mechanisms - Due diligence on the science and technology - Business model creation and commercialisation pathways - Market and industry assessment - Routes to market for clean technologies - Managing ventures
Literature	-
Comments	-

Module: Encapsulation of Functional Food Components (1507-410)

Module supervisor	Jochen Weiss
Relation to other modules	-
Prerequisites for attendance	Admission to a Master's program or the doctoral degree program at the Faculty of Natural Sciences. This module requires basic knowledge of food structures.
Teaching language	English
ECTS	7,5
Frequency of offer	every WS
Module duration	4 weeks (block 3)
Degree programs	Food Microbiology and Biotechnology (Master, since 01.10.2013) 3. Semester, elective Food Science and Engineering (Master, since 01.10.2013) 3. Semester, elective Food Chemistry (Master, since 01.10.2015) 3. Semester, elective (Doctoral degree programmes, since 14.02.2015) 1. Semester, elective Food Biotechnology (Master, since 01.10.2016) 3. Semester, elective Food Systems (Master, since 01.10.2019) 1. Semester, elective
Length of the examination	20 minutes
Class attendance	20h
Self studying	205h
Amount of work	225 h workload
Professional competences	Upon completion of the module, students are expected to have gained an overview of the importance of encapsulation, and encapsulants for applications in food and related fields. The students are able to demonstrate an understanding of (i) the physicochemi-cal properties of functional ingredients, (ii) the fundamental physical and chemical processes governing the behavior and stability of the encapsulation systems, and (iii) principles of encapsulation technologies and key processing parameters, and apply this knowledge to encapsulation-related challenges. Furthermore, the students are able to explain, evaluate, and communicate their findings/solutions to their peers and professionals.

	Upon completion of the module, students are able to work as a part of a team, and develop stronger communication skills by completing assignments and designing clear and well-organized presentations. The students are expected to apply critical and analytical thinking to solve encapsulation-related challenges. Furthermore, the students are encouraged to demonstrate their critical and analytical thinking skills by asking critical questions during the student presentations. Students are able to improve their written and oral English skills.
Comments	Available places: 16 Registration: latest 2 weeks before the begin of the module Registration period (Anmeldezeitraum): at the beginning of semester (zu Semesterbeginn) Criteria for asssigning available study places (Kriterien, nach denen Studienplätze vergeben werden): On first come, first-served basis.
Module examination	Presentation: Development project Oral exam (75% of the module grade) Development project and its presentation (25% of the module grade)
Course achievement	presentation
Encapsulation of Functional Food Components (1507-411)	
Person(s) responsible	Jochen Weiss Christian Krupitzer
Type of element	lecture with exercise course and lab hours
Hours per week	4
Contents	This module reviews the principles of encapsulation and aims to deliver knowledge of encapsulation systems and encapsulation processes. The goal of this module is to develop skills needed in encapsulating functional components in food or related industries. Industry-hosted lectures give insights into encapsulation from an industrial point-of-view. Student assignments aim to promote knowledge transfer and enable the students to apply scientific concepts and scientific literature. These assignments involve, for example, a literature-based development project and a laboratory study. Both assignments will be also orally presented during the module
Literature	Encapsulation Technologies for Active Ingredients and Food Processing, Verlag Springer, Berlin, 2009, ISBN: 978-1441910073 Encapsulation and Controlled Release Technologies in Food Systems Blackwell Publishers, New York, 2007, ISBN: 978-0813828558 Encapsulation and Controlled Release Woodhead Publishers, New York, 1993, ISBN: 978-1855738201

Comments	Maximum number of participants: 12

Module: Food Process Design II - Process Integration and Scale up (1503-500)

Module supervisor	Reinhard Kohlus
Relation to other modules	-
Prerequisites for attendance	Knowledge of equivalent to Food Process Design I, e.g. Basics of fluid mechanics, mass and heat transfer, unit operations in food processing.
Teaching language	English
ECTS	7,5
Frequency of offer	every SS
Module duration	4 weeks (block 3)
Degree programs	Food Microbiology and Biotechnology (Master, since 01.10.2013) 2. Semester, elective Food Science and Engineering (Master, since 01.10.2013) 2. Semester, elective Food Biotechnology (Master, since 01.10.2016) 2. Semester, elective Food Systems (Master, since 01.10.2019) 2. Semester, elective
Length of the examination	120 minutes
Class attendance	-
Self studying	-
Amount of work	56 h attendance + 154 h independent study = 210 h workload
Professional competences	The students will learn to structure a line design problem and place it in the economical context. They will be able to make a systematic construction based on the main process-product interactions. They know the principles of the design of experiment approach and can apply these to a process design question. The students are able to solve scale up problems by principles of similitude. The learned skills focus on applicable knowledge which is based on strong basic / theoretical foundations allowing to apply it in a wide context. A key skill needed in this context is the ability to combine the set of tools to appropriately tackle a complex process design problem. Key competencies addressed in this module are threefold: decision making and dealing with complexity, understanding different roles in project management and team work and lastly professional communication with business partner.
Comments	Maximum number of participants: 24 Registration via ILIAS

Module examination	Written or oral exam depending on the number of participants.
Course achievement	-
Food Process Design II – Process Integration and Scale up, Lecture and Exercise (1503-501)	
Person(s) responsible	Reinhard Kohlus
Type of element	lecture with exercise course
Hours per week	4
Contents	Set-up of requirement lists, systematic construction processes (i.e. conceptual process design), apparatus and plant engineering and construction, Process-product interactions, Robust plant design, Process scale up, Design of experi-ments for process modelling. Hygienic design rules and cleaning considera-tions (cip, wip, sip), process control strategies and process optimization.
Literature	Blass, E.; Entwicklung Verfahrenstechnischer Prozesse; Springer, Berlin (1997) Zlokarnik, M.; Scale up ; WILEY-VCH Verlag GmbH (2005) Kleppmann, W.; Taschenbuch Versuchsplanung; Hanser Verlag 2008 Douglas, J.,M. ; Conceptual Design of Chemical Prozesses; Mac GrawHill, Boston 1976 Hauser, G.; Hygienische Produktgestaltung; WILEY-VCH Verlag GmbH (2007)
Comments	List of English literature will be provided at start of course
Food Process Design II - Process Integration and Scale up - Praktikum (1503-502)	
Person(s) responsible	Reinhard Kohlus
Type of element	internship
Hours per week	-
Contents	-
Literature	-
Comments	-

Module: Food product re-formulation (Reading 2)

Module supervisor	Dr Julia Rodriguez-Garcia
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every SS
Module duration	1 semester
Degree programs	Food Systems (Master, since 01.10.2019) 2. Semester, semi-elective
Length of the examination	summative assessment - examination
Class attendance	50 h attendance
Self studying	175 h independent study
Amount of work	225 h workload
Professional competences	**Learning outcomes** On completion of this module, students should be able to: • Interpret current legislation and consumer trends to justify the need of product reformulation at a business and fundamental research level. • Evaluate the nutritional composition and value of a food product in order to recommend potential reformulation strategies to adapt its profile to current needs. • Evaluate the technological functionality of food ingredients in food products and their interactions in the system and within the production process in order to select the most suitable one • Identify the key technological steps (unit operations) in the development (reformulation) process including packaging and storage. • Analyse and interpret key quality and stability attributes (microbiological, physical, chemical and sensorial

	properties) in reformulated products using appropriate analytical procedures • Identify the policy requirements to comply with UK/EU legislation, including nutrition, labelling and any health claim on a new ingredient or reformulated food product • Assess the economic costs of the reformulated products • Critically design and evaluate the reformulation process of a specific product with a multidisciplinary and collaborative approach • Effectively communicate to specialist and stakeholders to influence in the decision making process of product reformulation Self-evaluation of your strengths and weaknesses in the subject knowledge and interpersonal skills to manage your independent learning **Skills:** • Application of knowledge • Critical thinking • Research skills • Enhanced team working and presentation skills. • Inter-professional skills
Comments	for detailed information on this module, please check FBMPRE-Food Product Reformulation
Module examination	Dissertation (40%) + Project output (10%) + Oral assessment and presentation (50%)
Course achievement	-
Contents	• The business environment: setting of the organisation, catalysis for change and innovation • Drivers for food reformulation and factors to consider from a nutritional and food science perspective • Factors determining the selection of appropriate constituents and processing methodology (e.g. selection of mixing strategies, gelling agents, emulsifiers etc.) • Design flow diagrams to describe the stages from ingredients via process to product. • Outline of the key quality and stability attributes (microbiological, physical, chemical and sensorial properties) to assess in ingredients, food systems and final products to optimise the reformulation process. • Food legislation: ingredients and product specifications, claims, etc. • Understanding costings on product reformulation

	• Development of product prototypes at different stages to prove concepts in the experimental kitchen/pilot plant. Measurement of appropriate chemical, physical properties • Consumer perspective on reformulated products: nutritional education, food choice, etc. • Business model: marketing, consumer type, competitors
Type of event	Lecture with practical units, workshops (and tutorials)

Module: Food Safety, Health and Disease (Belfast 3)

Module supervisor	Dr. Su Qiaozhu
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every SS
Module duration	1 semester
Degree programs	Food Systems (Master, since 01.10.2019) 2. Semester, semi-elective
Length of the examination	continuous assessment
Class attendance	45 h attendance
Self studying	180 h independent study
Amount of work	225 h workload
Professional competences	**Learning outcomes** Upon successful completion of this module students should be able to: • demonstrate knowledge on topical issues linking food consumption, food safety and human health risks; • assess the risks associated with a range of biological and chemical contaminants within the food chain **Skills:** Transferability/Employability: Oral and written communication; obtaining information from published literature. Subject specific: increased knowledge of key aspects linking food to human health. Cognitive skills: apply acquired knowledge to task management within group working situations.
Comments	-
Module examination	Assessment report (60%) + Exercise (40%)

Course achievement	-
Contents	Exploration of various biological and chemical agents potentially present in animal feeds and human foods and examination of associated links to human health defects/disease progression. Description of hazard and contaminant routes into the agri-food supply chain and the potential health impacts associated with the consumption of contaminated foods. Examination of the acute and chronic effects of exposure to chemical biotoxins in food and persistent environmental pollutants which bioaccumulate through the food chain. Positive aspects of food and implications for the use of food constituents such as nutraceuticals for health promotion/disease prevention purposes.
Type of event	Lecture

Module: Free Project Work (1500-020)

Module supervisor	Lutz Fischer
Relation to other modules	-
Prerequisites for attendance	M.Sc. Food Biotechnology
Teaching language	English
ECTS	7,5
Frequency of offer	every semester
Module duration	by arrangement
Degree programs	Food Microbiology and Biotechnology (Master, since 01.10.2013) 2. Semester, elective Food Science and Engineering (Master, since 01.10.2013) 2. Semester, elective Food Science and Engineering (Master, since 01.10.2013) 3. Semester, elective Food Microbiology and Biotechnology (Master, since 01.10.2013) 3. Semester, elective Food Biotechnology (Master, since 01.10.2016) 2. Semester, elective Food Biotechnology (Master, since 01.10.2016) 3. Semester, elective Food Systems (Master, since 01.10.2019) 1. Semester, elective
Length of the examination	30 minutes
Class attendance	-
Self studying	-
Amount of work	210 h
Professional competences	Upon completion of this module students - have gained insight into a current research project - understand the theoretical foundation and methodology of the research project - acquire practical experience by employing the methodology - learn how to properly document research findings - acquire experience in presenting research findings orally
Comments	Maximum number of participants: 3 Students have to find a professor to supervise the project.
Module examination	Report (50%) and Presentation (50%) Report and Presentation
Course achievement	-

Free Project Work (1500-021)	
Person(s) responsible	
Type of element	project work

Hours per week	-
Contents	-
Literature	-
Comments	-
Free Project Work (1500-021)	
Person(s) responsible	
Type of element	project work
Hours per week	-
Contents	-
Literature	-
Comments	-

Module: Functional Food: Design and validation (Madrid 3)

Module supervisor	Luis Vázquez
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every WS
Module duration	1 semester
Degree programs	Food Systems (Master, since 01.10.2019) 3. Semester, semi-elective
Length of the examination	continuous Assessment
Class attendance	79 h attendance
Self studying	146 h independent study
Amount of work	225 h workload
Professional competences	**Learning outcomes** Upon successful completion of this module students should be able to: • Know the bioactive ingredients in the diet and design the incorporation of functional ingredients into a base food, evaluating the effectiveness of the product and consumer acceptance. • Use state-of-the-art methods, processes and techniques for the creation and growth of new companies, and translate innovations into viable business solutions for the food system, especially aimed at foods for specific health use. • Ability to collaborate in the different phases of the food system with integrity, helping to build responsible organizations and value chains, meeting the objectives of nutrition and health. • Know the different types of functional ingredients and their natural sources. Learn its identification and

	quantification through advanced analysis, as well as the evaluation of its biological activities, bioavailability and bioavailability. • Be able to apply innovative technologies for obtaining bioactive ingredients and for incorporation into food matrices (formulation).
Comments	for detailed information on this module, please check Functional ingredientes: design and validation / Ingredientes funcionales: diseño y validación
Module examination	Weight (min- max): Exam (40% – 70%) + Reports/team work (20% - 50%) + Practical sessions (10% - 40%)
Course achievement	-
Contents	• Production and Chemical Analysis of Bioactive Ingredients • Biological Activity of Food Compounds • Functional Food Development
Type of event	Lecture with practical unit

Module: Global Agri-food Systems: Conventional, Organic, and Beyond (4302-460)

Module supervisor	Claudia Bieling
Relation to other modules	This module is of particular interest for students who intend to choose the modules "Ethical Reflection on Food and Agriculture" and "Gender, Nutrition and Right to Food".
Prerequisites for attendance	Acceptance into the above programme or basic knowledge and/or strong interest in social sciences
Teaching language	English
ECTS	6
Frequency of offer	every WS
Module duration	1 semester
Degree programs	Organic Agriculture and Food Systems (Master, since 01.10.2014) 1. Semester, compulsory Earth System Science (Master, since 01.10.2013) 3. Semester, elective Bioeconomy (Master, since 01.10.2014) 3. Semester, elective Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 3. Semester, elective
Length of the examination	20 minutes
Class attendance	-
Self studying	-
Amount of work	56 h presence + 124 h preparation at home = 180 h workload
Professional competences	After completing this course, students have a comprehensive understanding of agri-food systems and the paradigmatic shifts within. Students are in particular able to specify the diverse motivations and politics that have led farmers, consumers, and policy makers toward (or away from) more sustainable agri-food systems. They are familiar with the geographical, sociological, historical, political, legal, and economic aspects of how and why individuals, groups, and industries make (or are involved in) certain choices about food throughout the food chain (production, processing, trade, consumption). To make sense of global agri-food systems, students are introduced to a theoretical framework that helps understand changes in food provisioning: In the 19th century, the bases of contemporary agri-

	food systems were established, but it is in the 20th century that they changed again; agri-food systems underwent a further period of transformation as the industrial processing of food, the emergence of large food transnational corporations and the integration of ever widening portions of the globe into the world food system restructured world food relationships. These series of changes have had dramatic consequences on agriculture and land use; it is from this that alternative forms of agriculture emerged and the organic movement blossomed, for instance. Factoring in an increasing array of ecological shocks and threats like climate change and peak oil, and dramatically changing cultural and political dynamics around food, agriculture and land use, the next turn to "local" and "traditional" gives a perspective of the big changes food systems underwent. Students are hereafter aware of the possible outcomes of the current developments in organic and sustainable agriculture. In this course, students are provided with the conceptual tools to understand the sociological bases around which a future world of agriculture, food and land use will possibly take shape. Students have an insight into the political and social importance of food and agriculture and are able to identify different kinds of politics around agriculture and food production and consumption. Finally, they are able to explain basic concepts and theories related to organic agriculture and sustainability and have an understanding for the complexity of agriculture and food as it relates –among others– to the politics of resources, the environment and social justice. During preparation for the exam, while writing their essay (written paper) and preparing and following up on the seminar, students practice self-reliance, time management and team work. They learn and practice both critical and analytical thinking and reading of scientific literature. Writing the essay enhances their scientific articulateness. During discussions in class, students practice and improve their capability of exploring a scientific issue and of orally presenting an academic argument. With the help of dedicated tutorials, students are further supported with creating an essay plan and essay writing, quoting, referencing, and using academic and non-academic sources (therefore avoiding plagiarism).
Comments	The written paper (compulsory assignment) comprises an essay on topics related to course

	contents, to be submitted during the course. This course is taught by Dr. Cinzia Piatti.
Module examination	Oral exam (50 %)
Course achievement	Written paper (50 %)
Global Agri-food Systems: Conventional, Organic, and Beyond (4302-461)	
Person(s) responsible	Claudia Bieling
Type of element	seminar
Hours per week	4
Contents	This course has been designed to provide a comprehensive understanding of agri-food systems and make sense of paradigmatic shifts within. There are four main sections in this course: • Understanding the background • Understanding the contemporary paradigm • Understanding the emergence of alternatives • Adapting to transition These sections will unfold in order to make sense of the global agri-food systems and make sense of the social conditions that permitted the emergence of organic and sustainable agriculture, exploring the background and explaining the relationships between developed and developing countries, and conversely between global and local. Specific case studies relating to the course contents and from various geographic regions reinforce the learning process through enhanced discussions and critical reflection. Preparatory reading of selected literature and introduction to academic journal-based literature research and scientific writing complete the academic picture.
Literature	Course-relevant readings will be made available or uploaded in ILIAS if possible.
Comments	Because of limited space available (70 students), students must register via ILIAS. A waiting list will be available if the number of registrations will exceed expectations. This course is taught by Dr. Cinzia Piatti.

Tutorial Global Agri-food Systems: Conventional, Organic, and Beyond (voluntary) (4302-462)	
Person(s) responsible	Claudia Bieling
Type of element	tutorial
Hours per week	2
Contents	-
Literature	-
Comments	-

Module: Information Technologies and Expert Systems in Plant Protection (3602-460)

Module supervisor	Roland Gerhards
Relation to other modules	-
Prerequisites for attendance	It is required that the students have a strong background in crop protection and crop sciences. Otherwise it is not possible to successfully perform the pratical courses in the module.
Teaching language	English
ECTS	6
Frequency of offer	every SS
Module duration	1 semester with a blocked part
Degree programs	Crop Sciences - Plant Nutrition and Protection (Master, since 01.10.2014) 2. Semester, elective Food Systems (Master, since 01.10.2019) 2. Semester, elective
Length of the examination	120 minutes
Class attendance	-
Self studying	-
Amount of work	56 h presence + 124 h preparation at home = 180 h workload
Professional competences	After successfully completing the module, students are qualified in using sensor- and information technologies to identify biotic stress symptoms in crops. This includes both practical sensor measurements and the analysis and interpretation of sensor data. Based on field observations and sensor measurements, students are able to derive recommendations for crop protection and plan and realize plant protection measures. Students enhance their organizational skills, self-reliance, time management and team work skills during preparation for the exam, while preparing and following up on lectures and during the exercises while preparing the two presentations. They learn and practice both critical and analytical thinking and reading of scientific literature when preparing the presentations, while generally improving their ability of exploring a scientific subject. While preparing the presentations, students improve their scientific articulateness and further improve their oral communication skills.

Comments	For the block course "Ihinger Hof", a special registration is needed.
Module examination	Written exam (70%)
Course achievement	Two presentations with discussion (15% each)
Sensor Technologies for Plant Protection (3602-461)	
Person(s) responsible	Roland Gerhards
Type of element	lecture
Hours per week	1
Contents	In this course students will learn about optical sensors to measure biotic stress symptoms on crops. Image analysis systems will be introduced for automatic plant species discrimination based on shape analysis. Sensors will also be presented to locate agricultural machinery and measure soil characteristics that are relevant for plant protection decisions.
Literature	Will be presented during the lecture.
Comments	-
Application Technologies and Expert Systems in Weed Mangement with Exercises (3602-462)	
Person(s) responsible	Roland Gerhards
Type of element	seminar with exercise course
Hours per week	3
Contents	The objective of this course is to provide detailed knowledge about application technologies, sensor techniques and information technology in chemical and physical plant protection. The students learn to apply and analyse various application technologies and design new technologies in combination with decision support systems in plant protection. Decision Support Systems will be presented that predict weed-crop competition, population dynamics of weed species and use data of dose-response studies to select the most efficient, economic, ecological and selective weed control method in major crops. Field studies will be demonstrated to test and analyse those decisions.
Literature	Will be presented during the course.
Comments	The course will take place at the Research Station Ihinger Hof. 5 days in June from 8 a.m. to 5 p.m. Students will get accomodation and food at Ihinger Hof. A separate (personal) registration in the office of Phytomedicine is necessary.

Module: Integrated Bioprocess Engineering - Bioseparation Process Science (Downstream Processing) (1510-430)

Module supervisor	Rudolf Hausmann
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	German/English
ECTS	7,5
Frequency of offer	every WS
Module duration	4 weeks (block 3)
Degree programs	Biology (Master, since 01.10.2010) 3. Semester, elective Food Biotechnology (Master, since 01.10.2016) 3. Semester, elective Food Science and Engineering (Master, since 01.10.2013) 3. Semester, elective Bioeconomy (Master, since 01.10.2014) 3. Semester, elective (Doctoral degree programmes, since 14.02.2015) 1. Semester, elective Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 3. Semester, elective
Length of the examination	20 minutes
Class attendance	90h
Self studying	135h
Amount of work	90 h attendance + 135 h independent study = 225 h workload
Professional competences	The participants should obtain a theoretic overview of all relevant process steps used in the purification of industrial bioproducts. At the end of the module they should be able to outline a product-specific scheme of purification. In a hands-on training the participants will have performed and analyzed some selected methods. After the completion of the module the participants - have demonstrated working in a self-organized team - have analyzed and interpreted experimental data and discussed them theoreti-cally - have experienced and adapted to an interdisciplinary field. - have enhanced their scientific written and verbal skills.
Comments	Available places: 9 Registration for module: by email to: bvt@uni-hohenheim.de Registration period: until the last working day before the module start

	Criteria for admission is granted: Mostly after first-served basis.
Module examination	Laboratory performance, lab book and colloquium (20%), seminar presentation (20%), oral exam (60%)
Course achievement	Regular and active participation in the laboratory course (laboratory notebook and scientific report), the lecture, the exercises and the holding of a seminar talk.
Downstream Processing (1510-431)	
Person(s) responsible	Rudolf Hausmann
Type of element	lecture with seminar
Hours per week	4
Contents	The module comprises a lecture, a seminar and a lab hands-on training in which the purification of bioproducts from the original state as a component of a fermentation broth through progressive purification steps to a final product are the topic. Outline: 1) Introduction 2) Solid-Liquid Separation 3) Cell Disruption 4) Precipitation and Crystallization 5) Preparative Chromatography 6) Membrane Separation 7) Extraction 8) Refolding 9) Summary
Literature	R. G. Harrison, P. Todd, S. R. Rudge, D. P. Petrides (2003): Bioseparations Science and Engineering, Oxford University Press
Comments	Attendance and active participation in the laboratory course is mandatory. Due to the fact that every group has full responsibility for performing their own experiment, in-lab times will be flexible but require reasonable planning on the main experimental days.

Module: Internship FS (Industrial Placement) (1507-420)

Module supervisor	Jochen Weiss
Relation to other modules	-
Prerequisites for attendance	Admission to the Master's programme has to be present when beginning the internship. The internship can be completed at a national or international research center or at a research and development department of a company in Germany or abroad that is related to the Life Sciences: food, pharmaceutical as well as their supplying industries, plant design and engineering and process technology.
Teaching language	German/English
ECTS	7,5
Frequency of offer	every semester
Module duration	1 semester
Degree programs	Food Systems (Master, since 01.10.2019) 1. Semester, elective
Length of the examination	-
Class attendance	-
Self studying	-
Amount of work	225 h workload
Professional competences	Upon completion of this module students - have gained insight into research and development in the area of food science and engineering - expand their methodological repertoire Upon completion of this module students - have gained insight into organizing research projects -have sharpened their critical thinking skills when developing practical solutions - have learned how to work by trial and error - improve their team and communication skills
Comments	Students choose a supervisor related to the subject-area prior to beginning their internship (Prof. Hinrichs, Prof. Carle, Prof. Kohlus, Prof. Weiß, Prof. Hitzmann, Prof. Schmidt). The supervisor decides whether the internship placement is appropriate and assesses the report.rnrnThis module does not count towards the final grade.rnrnPlease note: whereas only 7,5 ECTS can be awarded, the duration of the internship is not limited to 6 weeks.
Module examination	written report Internship report
Course achievement	-

Internship FS (Industrial placement) (1507-421)	
Person(s) responsible	
Type of element	internship
Hours per week	-
Contents	-
Literature	-
Comments	-

Module: Irrigation and Drainage Technology (4403-410)

Module supervisor	Joachim Müller
Relation to other modules	-
Prerequisites for attendance	Basic knowledge in soil science, soil tillage and irrigation.
Teaching language	English
ECTS	7,5
Frequency of offer	every SS
Module duration	4 weeks (block 4)
Degree programs	Agricultural Sciences in the Tropics and Subtropics (until WS 2018/19) (Master, since 01.10.2014) 2. Semester, elective Food Systems (Master, since 01.10.2019) 2. Semester, elective Agricultural Sciences in the Tropics and Subtropics (from WS 2019/20 on) (Master, since 01.10.2019) 2. Semester, elective Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 2. Semester, semi-elective Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 2. Semester, semi-elective Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 2. Semester, semi-elective Environmental Protection and Agricultural Food Production (until WS 2018/19) (Master, since 01.10.2014) 2. Semester, semi-elective Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 2. Semester, semi-elective Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 2. Semester, semi-elective Environmental Protection and Agricultural Food Production (from WS 19/20) (Master, since 01.10.2019) 2. Semester, semi-elective
Length of the examination	120 minutes
Class attendance	-
Self studying	-
Amount of work	70 h presence + 155 h preparation at home = 225 h workload

Professional competences	After completing this module students know what the limitations and sensitivities of water and soil resources are. They are acquainted with methods for protecting these resources in agriculture. Apart from fundamental knowledge about water and soil, the diverse interactions in the soil-water-plant system are imparted and the economical and ecological aspects discussed. The students learn various methods of soil and water conservation. They are able to choose the most appropriate method among different solutions and to employ it efficiently, taking the social context into account. critical and analytical way of thinking, self-dependend working style, written and verbal skills, communication and cooperation capabilities
Comments	-
Module examination	Written (100%)
Course achievement	-
Irrigation and Drainage Technology (4403-411)	
Person(s) responsible	Joachim Müller
Type of element	lecture with exercise course and excursion
Hours per week	5
Contents	Multilateral conflicts of water access; competition for water (agriculture, industry, municipal use); environmental, economic and social impacts. Soil functions and potentials, soil classification, soils of rain forest ecosystems, soil fertility constraints in rain forest soils, soils of the Savanna zone, problems of soil erosion, physical problems of Savanna soils. Soil conservation methods, conservation tillage systems, zero-tillage systems. Utilization problems in arid lands, dessertification, salinization. Pore system and water retention, water potential concept; the basics of a soil water model; the Darcy Law; solute and water transport in soils, basic principles of hydraulics, water lifting devices, water conveyance and measurement. Irrigation scheduling; design and operation of irrigation systems; design and maintenance of drainage systems; salinity control; field performance evaluation; sensor controlled irrigation; surface and subsurface micro irrigation; evaporation reducing technique. Water pricing, economy of water use, water rights and ownership, and water policy
Literature	-

Comments	After completing this module students know what the limitations and sensitivities of water and soil resources are. They are acquainted with methods for protecting these resources in agriculture. Apart from fundamental knowledge about water and soil, the diverse interactions in the soil-water-plant system are imparted and the economical and ecological aspects discussed. The students learn various methods of soil and water conservation. They are able to choose the most appropriate method among different solutions and to employ it efficiently, taking the social context into account.

Module: Leadership in Food System (Warsaw 1)

Module supervisor	Prof. Dr. hab. Tomasz Ochinowski et al.
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every WS
Module duration	1 semester
Degree programs	Food Systems (Master, since 01.10.2019) 3. Semester, semi-elective
Length of the examination	-
Class attendance	60 h attendance
Self studying	165 h independent study
Amount of work	225 h workload
Professional competences	**Learning outcomes** By the end of the course the students should have developed a critical awareness regarding many of the moral and social issues which arise in international business today and be able to form reasoned judgements about the best ways to tackle these. They also: • know and understand the issues of social competences and team building concepts • are able to recognize people's competences and qualities needed to build an effective team referring to the acquired knowledge and validated research tools • are able to interpret the conditions of the group's evolution and the factors stimulating the group process • are able to diagnose relationships in a group and prepare memo reports from teamwork meetings in English • are able to use techniques for conducting discussions, brainstorming

	and organizing group work using “the devil's advocate” technique • are able to work in a team assuming different roles • are able to use on-line tools to support teamwork (including Facebook, LinkedIn, Skype, Google Drive, Dropbox, Trello) • able to self-educate and improve competences of functioning in a group **Skills:** After completing the course students are ready to: • make discussions, assertive statements and critical evaluation of the processes taking place in a group • comply with ethical standards • think and act in a creative way • observe the rules of professional ethics
Comments	for detailed information on this module, please check Master in Food Systems
Module examination	Written exam (70%) + Essay with presentation (30%)
Course achievement	-
Contents	The module focuses on managerial skills and a teamwork. This is where the profile of a responsible leader is shaped - somebody capable of predicting the consequences of their decisions and flexible to find themselves in a team work with various personalities and of different cultural customs.
Type of event	Lecture with workshop and conversation lab

Module: Management in Food System (Warsaw 3)

Module supervisor	Prof. Dr. Krzysztof Klincewicz
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every WS
Module duration	1 semester
Degree programs	Food Systems (Master, since 01.10.2019) 3. Semester, semi-elective
Length of the examination	-
Class attendance	60 h attendance
Self studying	165 h independent study
Amount of work	225 h workload
Professional competences	**Learning outcomes** After completing this course students know and understand • key and advanced theories and concepts in the field of management • basic types and forms of knowledge transfer and technology transfer • the processes and phenomena occurring in various types of organization of the food system and in the surrounding environment, including the principles of protection of industrial property and copyright • the contemporary civilizations' dilemmas as to the system of satisfying the society food needs • basic principles of creating and developing various forms of entrepreneurship and integrating the value chain in the food system • the concepts of logistics management and the place of logistics in management

	Skills: After completing this course students are ready to: • comply with ethical standards • think and act in an entrepreneurial manner • develop the achievements of the discipline and sustain the ethos of the profession • critically express opinions and discuss the issues of supply chain management • take responsibility for the impact of logistic activities on the environment • show creativity in designing and implementing the principles of systemic thinking
Comments	for detailed information on this module, please check Master in Food Systems
Module examination	Written exam (40%) + Project/Case Study (60%)
Course achievement	-
Contents	The module is to align the level of students' knowledge of management methods and techniques and to provide opportunity to broaden the knowledge and skills in the area of innovation management and supply chain.
Type of event	Lecture with project work and conversation lab

Module: Marketing in Food System (Warsaw 2)

Module supervisor	Dr. Agnieszka Wiśniewska
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every WS
Module duration	1 semester
Degree programs	Food Systems (Master, since 01.10.2019) 3. Semester, semi-elective
Length of the examination	-
Class attendance	60 h attendance
Self studying	165 h independent study
Amount of work	225 h workload
Professional competences	**Learning outcomes** After completing the module students know and understand: • the methodology of market research • the concept of marketing orientation and other key concepts of the area of marketing • the forms and structures of marketing activities in enterprises and the consequences of this structure for the system of marketing tools and activities • basic marketing laws and their impact on decision-making processes in food system organizations • the general methodology of consumer research as well as concepts and models related to the consumer decision-making process • the importance of consumer behaviour modelling for marketing activities designing • the determinants of consumer decision-making processes in the food market

	• the process of product development and commercialization in the food system and perceives it in design categories **Skills:** After completing the module students are able to: • broaden knowledge about consumer attitudes and behaviours • to express critical opinions and discuss the impact on the attitudes and behaviours of consumers, as well as to consult experts • comply with ethical standards, especially in the context of persuasion techniques, obtaining information and fair competition • think and act in a creative way • develop the profession of a marketer and maintain its ethos
Comments	for detailed information on this module, please check Master in Food Systems
Module examination	Test
Course achievement	Group assignment (homework)
Contents	The module covers the field of • marketing with particular emphasis on food market perspective • consumer behaviour • project management executed in projects of a marketing nature, such as the development and launching of the product on the market and discusses • the basics of project management • issues related to the decision-making process of the consumer and the external and internal determinants of consumer behaviour • the idea of marketing orientation, basic issues related to market research and segmentation, as well as a detailed characterization of marketing tools and related strategies in relation to the food market
Type of event	Lecture, discussion and workshop

Module: Masters Thesis Food Systems (1507-430)

Module supervisor	Jochen Weiss
Relation to other modules	-
Prerequisites for attendance	mind. 60 ECTS erbrachte Leistung
Teaching language	-
ECTS	30
Frequency of offer	every semester
Module duration	6 Monate
Degree programs	Food Systems (Master, PO vom 01.10.2019) 4.Semester, Pflicht
Length of the examination	-
Class attendance	-
Self studying	-
Amount of work	900 h
Professional competences	The Master's thesis demonstrates the ability to work independently on a topic in the field of food systems within a fixed period of time by applying scientific methods. Thesis work includes a literature review, compilation of new and original data derived from either field or laboratory work or a systems analysis and modelling as well as a period of write-up. - Creativity skills and competencies - Research skills and competencies - Intellectual transforming skills and competencies
Comments	Registration for the module on an individual basis in consultation with the supervising professor.
Module examination	The Master's thesis examination consists of a written part (thesis) and a presentation at the graduate conference. The grade of the presentation is weighted at 10%.
Course achievement	-

Module: Natural Science Concepts (1507-400)

Module supervisor	Christian Krupitzer Jochen Weiss
Relation to other modules	This module provides the basic knowledge on natural science concepts that is needed to accomplish the Master Program in Bioeconomy.rnrnIt is a prerequisite for the Module „Sustainable Industrial Processes“rn
Prerequisites for attendance	See admission regulations for the Master Programme Bioeconomy.
Teaching language	English
ECTS	6
Frequency of offer	every WS
Module duration	1 semester
Degree programs	Bioeconomy (Master, since 01.10.2014) 1. Semester, semi-elective Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 1. Semester, semi-elective
Length of the examination	90 minutes
Class attendance	-
Self studying	-
Amount of work	56 h presence + 104 h independent study + examrn= 160 h workload
Professional competences	After completion of the module, students are able to understand fundamental natural science concepts and have the ability to apply these concepts to Bioeconomy-related challenges. The students are able to define and explain key elements of natural sciences and to communicate their findings to colleagues and professionals from other disciplines. Students improve their communicative skills in scientific discourses and are able to understand and transfer fundamental natural science concepts.
Comments	Maximum number of participants: 45
Module examination	Written exam (100%)
Course achievement	-
Natural Science Concepts, Lecture (1507-401)	
Person(s) responsible	Reinhard Kohlus Jochen Weiss Herbert Schmidt Lutz Fischer Uwe Beifuß Jörg Hinrichs Walter Vetter

	Christian Krupitzer
Type of element	lecture
Hours per week	4
Contents	The module introduces fundamental concepts of “Natural Sciences” and aims to deliver basic knowledge in Chemistry, Microbiology, Biotechnology, (Food) Engineering, and Material Science. A case study, for instance on ‘Time Temperature Indicators”, fosters knowledge transfer and enables the students to apply the different concepts to one concrete example of application. Lecture-accompanying experiments and guided tours through the laboratories and pilot plants of the Institute of Food Science and Biotechnology are part of the course schedule. Moreover, 2 industry – hosted lectures further highlight the importance of natural Sciences as one of the key disciplines in Bioeconomy.
Literature	-
Comments	-

Module: Nutrition Communication (Reading 1)

Module supervisor	Charlotte Mills
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every SS
Module duration	1 semester
Degree programs	Food Systems (Master, since 01.10.2019) 2. Semester, semi-elective
Length of the examination	summative assessment - examination
Class attendance	16 h attendance
Self studying	209 h independent study
Amount of work	225 h workload
Professional competences	**Learning outcomes** On completion of this module, students should be able to: • recognise the legal, moral and ethical confines of nutrition profession and practice • apply the scientific principles of nutrition science in communication • critically assess and effectively relay evidence-based nutrition research **Skills:** The module will support development of communication skills and support critical thinking skills beyond nutritional sciences, in the broader scientific setting.
Comments	-
Module examination	Oral assessment and presentation (45%) + Written assignment incl. essay (55%)
Course achievement	-

Contents	This module focuses on effective communication of nutrition. Topics include; legal, moral and ethical context of nutrition professional practice; health behaviours; working with the media; communicating in industry; using social media.
Type of event	Lecture with seminar

Module: Omics technologies (Madrid 2)

Module supervisor	Carolina Simó
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every WS
Module duration	1 semester
Degree programs	Food Systems (Master, since 01.10.2019) 3. Semester, semi-elective
Length of the examination	continuous assessment
Class attendance	75 h attendance
Self studying	150 h independent study
Amount of work	225 h workload
Professional competences	**Learning outcomes** Upon successful completion of this module students should be able to: • Understand the different analysis strategies based on omic techniques for studying the bioactivity of food components • Generate critical capacity for experimental design in omics studies focused on elucidating the effects of the bioactive components of food on the transcriptome, proteome or metabolome of a biological system. • Use state-of-the-art methods, processes and techniques for the creation and growth of new companies, and translate innovations into viable business solutions for the food system, especially aimed at foods for specific health use. • Ability to collaborate in the different phases of the food system with integrity, helping to build responsible organizations and value chains,

	meeting the objectives of nutrition and health. • Know the bases to apply omics technologies as an exploratory strategy for the study of the activity attributed to bioactive compounds in food. • Be able to analyse the results of omic analyses in order to formulate new hypotheses that help to elucidate the molecular mechanisms underlying the biological activity of bioactive compounds in food.
Comments	for detailed information on this module, please check Omics Technologies / Tecnologías ómicas
Module examination	Weight (min- max): Exam (40% – 70%) + Reports/team work (20% - 50%) + Practical sessions (10% - 40%)
Course achievement	-
Contents	• Genomics & transcriptomics • Proteomics • Metabolomics
Type of event	Lecture with practical unit

Module: Personal Nutrition and Chronic Diseases (Madrid 1)

Module supervisor	Ana Ramírez de Molina
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every WS
Module duration	1 semester
Degree programs	Food Systems (Master, since 01.10.2019) 3. Semester, semi-elective
Length of the examination	continuous assessment
Class attendance	75 h attendance
Self studying	150 h independent study
Amount of work	225 h workload
Professional competences	**Learning outcomes** Upon successful completion of this module students should be able to: • Understand the effects of bioactive components of food in chronic non-communicable diseases and in the aging process. • Propose precision nutrition strategies, identifying the specific needs of patients with cardiovascular, metabolic diseases, obesity or cancer. • Use state-of-the-art methods, processes and techniques for the creation and growth of new companies, and translate innovations into viable business solutions for the food system, especially aimed at foods for specific health use. • Ability to collaborate in the different phases of the food system with integrity, helping to build responsible organizations and value chains,

	meeting the objectives of nutrition and health. • Know and understand the mechanisms of action involved in the activity attributed to the different groups of functional ingredients, the diversity and complexity of the nutrient-gene interaction and their physiological response. • Be able to use genetic and genomic analysis to make nutritional recommendations based on scientific knowledge under construction. • Understand at the molecular level the effect of functional ingredients on chronic non-communicable diseases, such as obesity and aging, and evaluate putative molecular targets involved in the metabolic imbalances that occur during the process of development of the pathophysiological condition under study. • Learn to develop personalized nutritional strategies to prevent or mitigate symptoms linked to chronic diseases such as obesity and aging. • Be able to carry out practical applications for the design and development of nutraceuticals and foods for specific health use.
Comments	for detailed information on this module, please check Personal Nutrition and Chronic Diseases / Nutrición Personalizada y Enfermedades Crónicas
Module examination	Weight (min- max): Exam (60% – 80%) + Practical exercises (20% - 40%)
Course achievement	-
Contents	• Cardiometabolic Nutrition • Molecular Oncology • Aging • Nutritional Interventions
Type of event	Lecture with practical unit

Module: Plant Quality (3408-460)

Module supervisor	Uwe Ludewig
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	6
Frequency of offer	every WS
Module duration	1 semester
Degree programs	Earth System Science (Master, since 01.10.2013) 3. Semester, elective Crop Sciences - Plant Nutrition and Protection (Master, since 01.10.2014) 3. Semester, elective Bioeconomy (Master, since 01.10.2014) 3. Semester, elective Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 3. Semester, elective
Length of the examination	120 minutes
Class attendance	-
Self studying	-
Amount of work	56 h presence + 124 h preparation at home = 180 h workload
Professional competences	After successfully completing the module, students are able to describe the main requirements for the external appearance and physical composition of plant products (food, feed and other biobased products) from the perspective of the processor, marketer, consumer and legislator. They can specify means of influencing the quality by plant mineral nutrition (external quality, content and storage of value-adding ingredients; suppression of unwanted plant compounds) and can evaluate the possibilities of influencing the quality by mineral nutrition in comparison with other means, such as breeding (eg. genetically modified crops) and plant cultivation strategies. Students are familiar with quality concepts and the quality of the product beyond (eg. production quality). Students acquire these abilities in the lecture (2 SWS). In the accompanying seminar, students present and discuss original work from the literature and current aspects of plant quality in short lectures. A one-day excursion to LUFA Speyer gives an insight

	into the practice of the official quality control of agricultural products. During preparation for the exam, while preparing and following up on lectures and while preparing the seminar, students enhance their organizational skills, self-reliance, time management and team work. They learn and practice both critical and analytical thinking and reading of scientific literature in the seminar, while generally improving their ability of exploring a scientific subject. While preparing the seminar, students improve their scientific articulateness and further improve their oral communication skills, presentation techniques and discourse capacities through presenting their work.
Comments	-
Module examination	Written exam (70 %)
Course achievement	Presentation (25 %) with extended abstract (5 %)
Plant Quality (3408-461)	
Person(s) responsible	Uwe Ludewig Franz Wiesler Günter Neumann
Type of element	lecture with seminar
Hours per week	4
Contents	Structure 1. Definition, evaluation and influence of plant quality 2. The external quality of plants 3. The material composition of plants 3.1 Inorganic constituents (ess. minerals, nitrate, heavy metals) 3.2 Organic nitrogen compounds 3.3 Carbohydrates 3.4 Lipids 3.5 Organic Acids 3.6 Vitamins 3.7 Bioactive Substances

	3.8 Residues and Contaminants 4. Specific quality issues 4.1 Plant nutrition and quality of potato, sugar beet quality, quality of fruit, vegetable quality, wine quality 4.2 Plant nutrition and quality of conventional, integrated or alternative crops 5 Biotechnological methods to improve nutritional quality
Literature	• Current literature • Marschner's Mineral Nutrition of Higher Plants (2011, Academic Press)
Comments	-

Module: Portfolio-Modul (Master N) (1507-480)

Module supervisor	Jochen Weiss
Relation to other modules	In connection with an agrarian science elective module.
Prerequisites for attendance	Prior completion of the module “Introduction to Food Systems” is recommended.
Teaching language	German/English
ECTS	7,5
Frequency of offer	every semester
Module duration	semesterbegleitend | 1 Semester
Degree programs	M.Sc. Food Systems (Wahl, 1. Semester) M.Sc. Food Biotechnology M.Sc. Food Science and Engineering M.Sc. Lebensmittelchemie M.Sc. Ernährungsmedizin M.Sc. Biologie
Length of the examination	-
Class attendance	-
Self studying	-
Amount of work	-
Professional competences	• Application of academic knowledge, methods and skills in a limited-scope self-selected working and learning scenario (e. g. project, summer school, internship or similar) º identify own knowledge and skill gaps and describe existing competencies º select or compose a suitable limited-scope self-learning scenario in connection with the food system that profits from existing competencies, but holds challenges º devise an appropriate individual learning strategy to fill the gaps and overcome challenges º reflect on the learning process and produce a written record describing all aspects of the selected working/ learning scenario, adequate to academic standards
Comments	-
Module examination	written report
Course achievement	written report
Portfolio-Modul (1507-481)	

Person(s) responsible	Jochen Weiss
Type of element	project work
Hours per week	-
Contents	ECTS are awarded on the basis of the written report. The module is credited with 1 - 7,5 ECTS. The module is not separately graded. Suitable activities are e. g. summer schools, projects, lecture/workshop series, as well as short-term internships in the fields of agricultural production of food, food pro-cessing, distribution, marketing or logistics. (As a guideline, a project encompassing 5 full working days, described in a 5-page writ-ten report, can be credited with 1,5 ECTS)
Literature	-
Comments	As a guideline, a project encompassing 5 full working days, described in a 5-page writ-ten report, can be credited with 1,5 ECTS

Module: Post-Harvest Technology of Food and Bio-Based Products (4403-550)

Module supervisor	Joachim Müller
Relation to other modules	The module mediates methodological fundamentals for a MSc-Thesis in Post-Harvest Technology.
Prerequisites for attendance	Basic knowledge in natural sciences (bachelor degree).
Teaching language	English
ECTS	7,5
Frequency of offer	every SS
Module duration	4 weeks (block 2)
Degree programs	Agricultural Sciences in the Tropics and Subtropics (until WS 2018/19) (Master, since 01.10.2014) 2. Semester, elective Agricultural Sciences in the Tropics and Subtropics (from WS 2019/20 on) (Master, since 01.10.2019) 2. Semester, elective Biobased Products and Bioenergy (Master, since 01.04.2019) 2. Semester, elective Biobased Products and Bioenergy (Master, since 01.10.2019) 2. Semester, elective Food Systems (Master, since 01.10.2019) 2. Semester, elective Biobased Products and Bioenergy (Master, since 01.10.2014) 2. Semester, semi-elective Environmental Protection and Agricultural Food Production (until WS 2018/19) (Master, since 01.10.2014) 2. Semester, semi-elective Environmental Protection and Agricultural Food Production (from WS 19/20) (Master, since 01.10.2019) 2. Semester, semi-elective
Length of the examination	120 minutes
Class attendance	-
Self studying	-
Amount of work	70 h presence + 155 h preparation at home = 225 h workload
Professional competences	After studying the module, the students - know about causes and effects of post harvest losses - are able to assess quality of tropical staple foods and cash crops

	- understand thermodynamic and physiological processes during drying and storage and - are able to evaluate and select post-harvest technologies - critical and analytical way of thinking, self-dependend working style, written and verbal skills, communication and cooperation capabilities
Comments	-
Module examination	written exam (100 %)
Course achievement	-
Post-Harvest Technology of Food and Bio-Based Products (4403-551)	
Person(s) responsible	Joachim Müller Jens-Norbert Wünsche
Type of element	lecture with exercise course and excursion
Hours per week	5
Contents	Definition and importance of post-harvest technology. Analysis and evaluation of quantitative and qualitative post-harvest losses. Analysis of the effects of post-harvest losses on food supply and quality. Influence of material properties of tropical products on treatment and processing technology, as well as product quality. Fundamentals of mechanical, thermal, chemical, and biochemical post-harvest treatments (cleaning, sorting, separating, crushing, fermenting, drying, cooling, storing). Evaluation and selection of technologies in terms of performance and product quality. Quality assessment, monitoring and marketing of tropical and subtropical products. Mediation of fundamentals in lectures. Evaluation of selected technologies during excursions and exercises. Demonstration of technologies. PowerPoint presentation and lecture manuscript.
Literature	• Multon, J.L. (1988): Preservation and Storage of Grains, Seeds and their By-products. Cereals, Oilseeds, Pulses and Animal Feed. Lavoisier Publishing Inc., New York. • Shewfelt, R.L., Prussia, S.E. (ed.) (1992): Postharvest Handling: a System Approach. Academic Press, San Diego. • Chakraverty, A. (2001): Handbook of Postharvest Technology. Marcel Dekker, New York.
Comments	-

Module: Precision Farming (4404-520)

Module supervisor	Hans Griepentrog
Relation to other modules	This module shows links to other agricultural disciplins and improves the career perspectives in agricultural engineering.
Prerequisites for attendance	Basic knowledge in English, basic knowledge in process engineering in plant production or practical experience in this field is required.
Teaching language	English
ECTS	6
Frequency of offer	every SS
Module duration	1 semester
Degree programs	Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 2. Semester, elective Bioeconomy (Master, since 01.10.2014) 2. Semester, elective Agricultural Sciences - Major: Crop Production Systems (Master, since 01.10.2015) 2. Semester, elective Food Systems (Master, since 01.10.2019) 2. Semester, elective Agricultural Sciences - Agricultural Engineering (Master, since 01.10.2014) 2. Semester, semi-elective Agricultural Sciences - Agricultural Engineering (Master, since 01.04.2019) 2. Semester, semi-elective
Length of the examination	-
Class attendance	-
Self studying	-
Amount of work	56 h presence + 124 h preparation at home = 180 h workload
Professional competences	Students will be able to highlight fundamentals, including - background, potential and perspectives of Precision Farming -data base management and decision support systems (farm management information systems) - function and application of different technical solutions. Students can -apply and appraise precision farming technology and equipment - optimize plant production by understanding and applying sophisticated crop models and software.

	Critical and analytical thinking as well as language skills and communication and cooperation skills will be gained during presenting scientific paper related to Precision Farming in group work.
Comments	-
Module examination	written (computer aided; 100 %)
Course achievement	-
Precision Farming (4404-521)	
Person(s) responsible	Hans Griepentrog
Type of element	lecture with exercise course
Hours per week	4
Contents	Fundamental precision farming principles and description of spatial heterogeneity of soils and plants; data base structures, geographic information systems (GIS), global navigation satellite systems (GNSS) and variable rate technology (VRT) for the main operations in crop production, especially tillage, sowing, fertilisation and harvesting; decision support and economic evaluation
Literature	Heege, H.J. (2013): Precision in Crop Farming - Site-specific Concepts and Sensing Methods. Springer Dordrecht Heidelberg New York London
Comments	Lectures, demonstrations and practical exercises. Each student needs to contribute in a group of students to read, present and discuss a scientific paper as an exam prerequisit. The module is conducted in cooperation with teaching staff from other departments, international scientists and experts from different companies. Lecture handouts and other materials will be provided.

Module: Public Health Nutrition and Consumer Food Choice (Reading 3)

Module supervisor	Dr. Miriam Clegg
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every SS
Module duration	1 semester
Degree programs	Food Systems (Master, since 01.10.2019) 2. Semester, semi-elective
Length of the examination	summative assessment - examination
Class attendance	34 h attendance
Self studying	191 h independent study
Amount of work	225 h workload
Professional competences	**Learning outcomes** • A conceptual understanding of the relevant theories of behaviour change and demonstrate how these can be applied and then assessed in relation to nutrition interventions. • Determine through primary research a nutrition related health problem within the local environment • Design and critically evaluate a public health intervention for a nutrition problem within the University environment. • Demonstrate a critical awareness of the main factors that influence food choice throughout the lifespan. • Following comprehensive research, debate the degree and impact of factors such as age, gender, disease states, family, religion, cultural traditions and economics that influence food behaviour choice. **Skills:** Develop, agree and achieve group aims and outcomes.

Comments	for detailed information on this module, please check FBMPUB-Public health nutrition and consumer foodchoice
Module examination	Oral assessment and presentation (10%) + Written assignment incl. essay (60%) + Exercise (30%)
Course achievement	-
Contents	Food choice models, Food choice throughout the lifespan, economic and social factors influencing food choice, models of health behaviour change, behaviour change techniques, developing and critically evaluation public health interventions, working as nutritionist and applying the AfN Standards of Ethics, Conduct and Performance to case studies.
Type of event	Lecture with seminar (and tutorials)

Module: Scientific Writing and Reporting (1501-520)

Module supervisor	Herbert Schmidt
Relation to other modules	-
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every WS
Module duration	4 weeks (block 1)
Degree programs	Food Biotechnology (Master, since 01.10.2016) 1. Semester, compulsory Food Microbiology and Biotechnology (Master, since 01.10.2013) 1. Semester, compulsory Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 3. Semester, elective Food Science and Engineering (Master, since 01.10.2013) 3. Semester, elective Bioeconomy (Master, since 01.10.2014) 3. Semester, elective Food Systems (Master, since 01.10.2019) 1. Semester, elective
Length of the examination	-
Class attendance	-
Self studying	-
Amount of work	112 h attendance + 113 h independent study = 225 h workload
Professional competences	Students know how to - look for literature independently - use statistical methods for analysing experimental data and molecular -biological databases - maintain a laboratory journal - discuss the basic of scientific practice - analyse and discuss micro-biological and biotechnological publications - draft, write and discuss biotechnological presentations and publications - are able to articulate themselves well in the context of natural scientific topics, both in written and spoken form - give scientific presentations - actively participate in scientific discussions - use new experimental and analytical methods in the areas of biotechnology and microbiology
Comments	-
Module examination	Preparing and giving a ca. 30 minute presentation with ensuing discussion on a given natural scientific topic in English (internally graded, grade does not count towards the final grade)

Course achievement	-
Literature Research (1501-521)	
Person(s) responsible	Herbert Schmidt
Type of element	exercise course
Hours per week	2
Contents	Introduction to literature research (internet, library, interlibrary loan) Introduction to the analysis of statistical experimental data Exemplary display of molecularbiological databases for finding new or improving known proteins
Literature	-
Comments	This course is compulsory for all students of this MSc, also for those who have successfully completed the module Einführung in wissen-schaftliches Arbeiten (Bachelor's programme Lebensmittwelwissenschaft und Biotechnologie) (1502-020).
Scientific Publications (nicht mehr angeboten) (1501-522)	
Person(s) responsible	Herbert Schmidt
Type of element	seminar with exercise course
Hours per week	2
Contents	Introduction, theory and practice of scientific publications and presentations Students are given a topic / review & publication Preparation and independent presentation of a ca. 30-minute scientific presentation on a publication in the area of food microbiology and biotechnology with ensuing discussion
Literature	-
Comments	-
Introduction in Microbiological and Enzymatic Methods (nicht mehr angeboten) (1501-523)	
Person(s) responsible	
Type of element	internship
Hours per week	2
Contents	The students learn: - Sterile working techniques

	- Factorial growth kinetics - Determination of food ingredients (e.g. ethanol, glucose, fructose, sucrose, nitrate, citrate) by enzymatic methods - Determination of enzyme activities in food - To protocol experiments - Using statistical methods for analysing experimental data
Literature	Henniger, G. (2003) Enzymatic techniques for authenticating food components in Lees, M. (ed.) Food Authenticity and Traceability, CRC Press, 239-274
Comments	-

Module: Soft Matter Science II - Food Physics (1507-510)

Module supervisor	Jochen Weiss
Relation to other modules	Second part to Soft Matter I - Food Rheology and Structure
Prerequisites for attendance	Admission to a Master's program. Basic knowledge in physical chemistry and mathematics.
Teaching language	English
ECTS	7,5
Frequency of offer	every SS
Module duration	4 weeks (block 1)
Degree programs	Food Science and Engineering (Master, since 01.10.2013) 2. Semester, compulsory Food Microbiology and Biotechnology (Master, since 01.10.2013) 2. Semester, elective Bioeconomy (Master, since 01.10.2014) 2. Semester, elective Food Biotechnology (Master, since 01.10.2016) 2. Semester, elective Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 2. Semester, elective Food Systems (Master, since 01.10.2019) 2. Semester, elective
Length of the examination	90 minutes
Class attendance	-
Self studying	-
Amount of work	64 h attendance + 146 h independent study = 210 h workload
Professional competences	Upon completion of the module, students are expected to have gained knowledge of physical phenomena that play a role in food systems. The students are able to demonstrate an understanding of (i) molecular material science approach to food systems, and (ii) structure-function relationships in matrices composed of proteins, lipids, and carbohydrates, and (iii) the operating principles of advanced physical analytical techniques as well as their use in the analysis of complex food structures. The students are able to apply principles of molecular mass transport, solution thermodynamics, phase transitions, and molecular interactions to solve problem-oriented case studies in foods. Furthermore, the students are able to explain, evaluate, and communicate concepts and results to their peers and professionals.

	Upon completion of the module, students are able to work as a part of a team, and develop stronger communication skills by completing assignments and designing clear and well-organized presentations, posters and flash talks. The students are expected to apply critical and analytical thinking to solve food physics-related challenges. Students are able to improve their written and oral English skills.
Comments	Maximum number of participants: 50
Module examination	written examination, 3-min. Talk, Poster presentation, Poster Written exam (75% of the module grade). Oral exam optional. Three-minute talk (10%), Poster and its presentation (15%).
Course achievement	Laboratory presentation, Laboratory work
Soft Matter Science II - Food Physics (1507-511)	
Person(s) responsible	Jochen Weiss
Type of element	lecture with exercise course
Hours per week	4
Contents	This module reviews fundamental concepts of food physics, and aims to deliver knowledge of principles of physical phenomena (e.g., mass transport, solution thermodynamics, molecular and particle interactions, and phase transitions) in complex food matrices. Case studies highlight the connection between the theory and practical relevance. Student assignments aim to promote knowledge transfer and enable the students to apply the scientific concepts and scientific literature. These assignments involve calculation exercises, and generating individual flash talks and poster presentations based on current papers in the area of food physics.
Literature	Principles of Colloid and Surface Chemistry, CRC Press,1997, ISBN: 978-0824793975 Polymer Chemistry, CRC Press, 2007, ISBN: 978-1574447798 Phase Transitions in Foods (1. Ed), Academic Press,1995, ISBN: 978-0125953405 Phase Transitions in Foods (2. Ed) Academic Press, 2016, ISBN: 978-0124080867 Biophysics: An introduction, Springer, 2012, ISBN: 978-3-642-25211-2 Biophysics, Springer, 2002, ISBN: 978-1-4020-0218-2

Comments	The module consists of a lecture (online as videos) and exercise (online as videos/files) The module is taught online. Online live sessions are designed to answer student questions about the teaching material.

Module: SPOC: Introduction to Food Systems (1507-440)

Module supervisor	Jochen Weiss
Relation to other modules	The module „Introduction to Food Systems“ is one of the overarching modules in the curriculum. It addresses the entire international cohort and is taught in an online format (SPOC – specialized private online course). Its purpose is to introduce students to the food system, its elements and their systemic interactions.
Prerequisites for attendance	-
Teaching language	English
ECTS	7,5
Frequency of offer	every semester
Module duration	4 weeks (block 1)
Degree programs	Food Systems (Master, since 01.10.2019) 1. Semester, compulsory
Length of the examination	90 minutes
Class attendance	-
Self studying	-
Amount of work	225 h workload
Professional competences	Upon completion of the course, students can - define Food Systems and describe their importance to society. - explain key elements of system science - list the principal components of the food system -describe the systemic interactions and dependencies of the principal components of the food system -describe and evaluate potential effects of changes in components or sub-systems of the food system on the whole system - identify current challenges in the food system - critically evaluate different responses to these challenges - draft their own responses -identify and name gaps that prevent an integrated and functional Food System They can also - outline their own competence profile in different subfields of the food sector - formulate individual development goals
Comments	-
Module examination	50 % Essay (5-10 pages) + 50% written exam 50 % Essay + 50% written exam
Course achievement	-
Introduction to Food Systems (1507-441)	
Person(s) responsible	Jochen Weiss

Type of element	e-learning
Hours per week	4
Contents	The SPOC will introduce participants to the concept of Food Systems. They will learn about its origins and its potential use such as e.g. to create new value-added products and services to facilitate more sustainable and healthier diets, and foster circularity and resource efficiency. System science principles will be introduced to analyse and optimize the workings of complex systems. Finally, specific elements of Food Systems will be discussed and possible cases of new networks considered.
Literature	-
Comments	-

Module: Summer School: Introduction to Entrepreneurship (1507-470)

Module supervisor	Jochen Weiss
Relation to other modules	The Summer School is the 2nd of the overarching modules addressing the entire international cohort. It is conducted at the beginning of the 2nd semester and will introduce the concept of entrepreneurship in relation to the food system.
Prerequisites for attendance	The module builds on knowledge and skills acquired in the module “Introduction to the Food System”, to which the concepts and skills taught in this module are to be applied
Teaching language	English
ECTS	7,5
Frequency of offer	every SS
Module duration	4 weeks (block 1)
Degree programs	Food Systems (Master, since 01.10.2019) 2. Semester, compulsory
Length of the examination	30 minutes
Class attendance	-
Self studying	-
Amount of work	56 h attendance time + 169 h independent study = 225 h workload
Professional competences	Upon completion of the course, students will - understand concepts of innovation and entrepreneurship in the context of the food system, such as writing a business plan, financing and intellectual properties - be familiar with strategies for idea generation, design thinking and project management - be able to find innovative solutions to food systems problems Upon completion of the course, students will be able to - translate research into real-world impacts
Comments	-
Module examination	presentation presentation
Course achievement	-
Summer School: Introduction to Entrepreneurship (1507-471)	
Person(s) responsible	Jochen Weiss
Type of element	lecture with exercise course
Hours per week	-
Contents	Teaching and practice related to

	- design thinking, - ideas generation, - financing, - Intellectual Property - project management - business models - business plan development.
Literature	-
Comments	The Summer School will be delivered using the innovative teaching methods based on the flipped classroom concept.