UNIVERSITÄT HOHENHEIM

Modulhandbuch

für den Studiengang

Master of Science
Food Systems

Stand Oktober 2023

Inhaltsverzeichnis

Modul: Advanced Flavor Chemistry (1508-410)

Modulverantwortung	Yanyan Zhang
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Scientific background in chemistry and biotechnology
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 1)
Studiengänge	Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Systems (Master, PO vom 01.10.2019) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	60
Selbststudium (in Stunden)	165
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	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.
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	Written exam (80%), seminar (20%), practical course (passed)

Studienleistung und Gewichtung	Participation in lecture, seminar (presentation & report), and practice course (protocol)
Advanced Flavor Chemistry (1508-411)	
Person(en) verantwortlich	Yanyan Zhang
Lehrform	Vorlesung mit Übung
SWS	5
Inhalt	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
Literatur	Belitz, H.D., Grosch, W., Schieberle, P.: Food Chemistry. Springer, 2009. Berger, R.G.: Flavours and Fragrances. Springer, 2007.
Anmerkungen	-

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

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Admission to a Master’s program
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 1)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 3. Semester, Wahl Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 3. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 3. Semester, Wahl Food Systems (Master, PO vom 01.10.2019) 1. Semester, Wahl
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	60
Selbststudium (in Stunden)	165
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	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 operations 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.

	Furthermore, 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.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 16 Registration: Ilias 150g, please provide the name of your master program upon registration in Ilias. Registration period: Registration opens 4 weeks prior to the start of the semester Criteria according to which places are allocated: Students of the Food Science and Engineering program will be preferred in order of registration in Ilias (first come first served). Maximum number of participants: 16
Modulprüfung und Gewichtung	Written exam 80% and oral presentation 20%; oral or online exam optional
Studienleistung und Gewichtung	oral presentation
Advanced Meat Science and Techology (1507-501)	
Person(en) verantwortlich	Jochen Weiss Monika Gibis Kurt Herrmann
Lehrform	Vorlesung
SWS	4
Inhalt	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. In the course the lecturers demonstrate in a practical way the manufacturing of different kind of meat products like (emulsified, cooked and raw

	fermented sausages as well as cooked and raw ham). These products will get tested by a sensory during the course.
Literatur	Script to the module
Anmerkungen	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. Lectures and part of the demonstrations will be held online.
Advanced Meat Science and Technology (1507-502)	
Person(en) verantwortlich	Jochen Weiss Monika Gibis Kurt Herrmann
Lehrform	Praktikum
SWS	2
Inhalt	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.
Literatur	Script to the module
Anmerkungen	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(en) verantwortlich	Jochen Weiss Monika Gibis Kurt Herrmann

Lehrform	Exkursion
SWS	1
Inhalt	The participants of the module will have the opportunity to visit one or more industrial meat product manufacturing facilities.
Literatur	Script to the module
Anmerkungen	Depending on availability of industrial partners, this part of the course might be transformed into another learning material.

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

Modulverantwortung	Mario Jekle
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	English language skills
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 2)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Food Systems (Master, PO vom 01.10.2019) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	60
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	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.
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	a written exam
Studienleistung und Gewichtung	Passing the practical course
Advanced Process Engineering Techniques for Cereal Processing (1509-501)	
Person(en) verantwortlich	Mario Jekle
Lehrform	Vorlesung mit Exkursion und Praktikum
SWS	4
Inhalt	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
Literatur	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
Anmerkungen	-

Modul: Advanced Technologies for Dairy Products and Alternatives (1505-530)

Modulverantwortung	Jörg Hinrichs
Bezug zu anderen Modulen	The module complements analytically or process-engineering oriented modules with the background of processing of milk and plant based raw material to sophisticated milk products and alternative, e.g. milk and plant-based concentrates, isolates and their application up to powders.
Teilnahmevoraussetzung	Scientific background and basics in food microbiology, chemistry, engineering, and soft matter science.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester (Block 2)
Studiengänge	M.Sc. Food Biotechnology, 2. Semester (Wahl) M.Sc. Food Science and Engineering, 2. Semester (Wahl) M.Sc. Food Systems, 4. Semester (Wahl) M.Sc. Lebensmittelchemie, 4. Semester (Wahl) M.Sc. Bioeconomy, 2. Semester (Wahl)
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	84
Selbststudium (in Stunden)	96
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The students learn to understand the advanced processing of milk and plant-based raw material in relation to the physical, chemical and microbiological properties of the raw material and the final product properties. Thereby analytical tools to characterize composition and structure of products thereof are studied in order to understand material-process-function relationships. It also teaches the concept of mass and energy balance, the estimation of microbiological risk of products and the hazard associated with the various processing steps. The students develop their ability to work independently through practical exercises. In addition, they are expected to work in teams for some exercises, e.g. practical tasks, trouble shooting. Knowledge is deepened in composition, analytics, hygiene and aseptic, and processing by means

	of membrane filtration/fractionation, evaporation, powder processing. Finally, trouble shooting on practical issue will be done in groups and an outlook will be given to running research projects addressed on future developments and innovations.
empfohlene Vorkenntnisse	-
Anmerkungen	Anzahl Teilnehmerplätze: 25 Registration via ILIAS („First come, first served“) Students who have a contagious disease according to the Federal Epidemics Act are not allowed to participate!
Modulprüfung und Gewichtung	exam (90%), protocol (10%)
Studienleistung und Gewichtung	-

Science and Engineering of Advanced Processing (1505-531)

Person(en) verantwortlich	Jörg Hinrichs
Lehrform	Vorlesung
SWS	2
Inhalt	The topics are: 1. Physics, chemistry milk and plant based raw material 2. Chemical and physical analytics 3. Hygiene and Aseptic processing 4. Vacuum evaporation and concentrates 5. Membrane materials and processing 6. Drying basics 7. Drying 8. Trouble shooting methods 9. Research innovations and outlook
Literatur	Scientific literature, doctoral theses, publications from the department, textbooks in the departmental library. Encyclopedia of Dairy Science, 3rd Edition, 2021 Elsevier Verlag, Editor John W. Fu-quay, P. F Fox, Hubert Roginski, ISBN: 978-0-12818-767-8

	Kessler H.G.: Food & Bio-Process Engineering – Dairy Technology. Verlag A. Kessler, München 2011 Belitz H.D., Grosch W., Schieberle P. Food Chemistry.3rd Edition. 2004, Springer Verlag Lecture handouts
Anmerkungen	-
Seminar in advanced processing (1505-532)	
Person(en) verantwortlich	Jörg Hinrichs
Lehrform	Seminar
SWS	2
Inhalt	Rework lecture and questions, evaluation, discussion and deepening knowledge of the lecture.
Literatur	Scientific literature, doctoral theses, publications from the department, textbooks in the departmental library. Lecture handout
Anmerkungen	-
Pilot plant experiments in advanced processing (1505-533)	
Person(en) verantwortlich	Jörg Hinrichs
Lehrform	Übung mit Exkursion
SWS	2
Inhalt	Training in processing, analytics and sensory (from raw material to the final product) using membrane filtration, e. g. reverse osmosis and ultrafiltration in processing of raw material, fouling & cleaning, consumer milk and analogs & sensory, ice cream Excursion in processing companies (the latter cannot be guaranteed, as legal requirements/contact persons in companies can change rapidly).
Literatur	Lecture handout and exercise handout
Anmerkungen	Students who have a contagious disease according to the Federal Epidemics Act are not allowed to participate! Participation in the experiments in the pilot plant of the Hohenheim Research and Teaching Dairy is only permitted with appropriate protective clothing.

Modul: AgFoodTech (1507-450)

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	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.
Teilnahmevoraussetzung	Students have to be enrolled in the first semester of the Food Systems master program.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	4 Wochen (Block 2)
Studiengänge	M.Sc. Food Systems, 1. Semester, Pflicht M.Sc. Bioeconomy, 2./4. Semester, Wahl (Profil: Transforming Food Systems) M.Sc. Food Science & Engineering, 3. Semester, Wahl M.Sc. Lebensmittelchemie, 3. Semester, Wahl M.Sc. Ernährungsmedizin, 3. Semester, Wahl M.Sc. Medizinische Ernährungswissenschaft, 3. Semester, Wahl M.Sc. Molekulare Ernährungswissenschaft, 3. Semester, Wahl M.Sc. Molekulare Ernährungswissenschaft (ab Studienbeginn WS 23/24), 3. Semester, Wahl M.Sc. Agrarbiologie, 3. Semester, Wahl
Prüfungsdauer (in Minuten)	90
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	- 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
empfohlene Vorkenntnisse	-
Anmerkungen	Sign-up for module: in ILIAS The lectures of this course might be held online. Maximum of participants 15.
Modulprüfung und Gewichtung	Written exam. Oral or online exam optional.
Studienleistung und Gewichtung	-
AgFoodTech (1507-451)	
Person(en) verantwortlich	Jochen Weiss
Lehrform	Vorlesung mit Übung, Praktikum und Exkursion
SWS	4
Inhalt	AgFoodTech combines knowledge and skill from the fields of agrarian technology and food processing. For this, the module reviews the basics of different areas of food and agricultural science. The obtained knowledge is finally merged into a self-learning project.
Literatur	-
Anmerkungen	Please bote, 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.

Modul: Agricultural Production and Residues (3080-440)

Modulverantwortung	Eva Gallmann
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Prerequisites for participation: Basic knowledge of biological systems and of technical processes as well as about environmental problems of agriculture is expected. An open attitude to enter a new sector of knowledge about agricultural feed and food
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 semester
Studiengänge	Environmental Protection and Agricultural Food Production (Master) 1. Semester, compulsory Biobased Products and Bioenergy (Master) 3. Semester, elective Agricultural Sciences - Agricultural Economics (Master) 1. Semester, semi-elective Environmental Science - Soil, Water, and Biodiversity (Master) 3. Semester, semi-elective
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	The students are able to describe the major processes of agicultural production within an ecological environment. They can combine and analyse data from different studies and can illustrate interactions between agricultural production steps and the environment. The students are able to identify agricultural processes relevant for the ecosystem and can describe and analyse their interactions as well as the consequences of human activities in general. The students will aquire skills like critical and analytical thinking.
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	written exam (100%)
Studienleistung und Gewichtung	-

Agricultural Production and Residues (3080-441)	
Person(en) verantwortlich	Eva Gallmann Hans Griepentrog
Lehrform	Vorlesung mit Exkursion
SWS	4
Inhalt	Basics of Crop Production Systems • Crop development and yield determination • Crop rotation and soil tillage • Morphology of main species The lecture is supported by additional excursions to the experimental stations and practical exercises on morphology and physiology of crops. Basics of Mechanization in Crop Production • soil tillage (implements and systems) • sowing • fertilizing • spraying • harvesting (grass, small grains, corn, potatoes, sugar beets) The lecture is supported by demonstrations in the lab and in the field. This course presents just a short introduction into the field of mechanization so that some fundamental knowledge of farm machinery is expected. Basics of Animal Nutrition • Basics of ruminant and pig nutrition • Practical feeding (diets and feeding programs) • Nutrition physiology and species specific requirements • Principles of ration design • Minimizing of N- and P- input • Strategies to optimize efficiency and minimize pollution The lecture is supported by short field trips to the experimental stations of the University and farms Livestock Production Systems • Housing systems for dairy and beef cattle (freestalls; cubicle construction; ventilation, feeding and dung removal techniques)

	• Housing systems for pigs (pig houses, ventilation, feeding and dung removal techniques) • Housing systems for laying hens (free range, deep litter, aviary, cages, feeding technique) • Housing systems for broilers and turkeys (free range, deep litter open sided, deep litter window-less, feeding technique) • Gaseous emissions of ammonia, greenhouse gases, dust, odour, noise • Manure management (historical developments and actual situation in Germany, Europe and abroad, treatment techniques and processes for environmentally friendly utilization or for final decomposition). The lecture is supported by short field trips to the experimental stations of the University and to practical farms
Literatur	• º Sinclair, T.R. and F.P. Gardner: Principles of Ecology in Plant Production, CAB International, Wallingford, 1998 • º Stout, B. et. al.: CIGR-Handbook of Agricultural Engineering, Plant Production Engineering (Vol.3), St. Joseph/USA, 1999 • º Jeroch/Drochner/Simon: "Ernährung Landwirtschaftlicher Nutztiere" Verlag Ulmer, Stuttgart. º Flachowski, G. (1992): Nährstoffökonomische, energetische und ökologische Aspekte bei der Erzeugung von essbarem Protein tierischer Herkunft. Arch. Geflügelk. 56: 233-240 • º Burton et al. (2003): Manure management in Europe, Silsoe Research Institute, Bedford, GB º Lindley J.A. and J.H. Whitaker: Agricultural buildings and structures, ASAE St. Joseph 1996 º Groot Koerkamp, P.W.G., et al. (1998): Concentration and emissions of ammonia in livestockbuildings in Northern Europe. J. Agric. Eng. Res. 70: 79-95 º Takai, H. et al. (1998): Concentration and emissions of airborne dust in livestock

	buildings in Northern Europe. J. Agric. Engin. Res., 70: 59-77 º Appleby et al., (1992): Poultry Production Systems. CAB International, Wallingford, U.K. º Eichhorn, H.: Landtechnik, Ulmer, Stuttgart 1999 (in German) º www.ktbl.de º www.sri.bbsrc.ac.uk/science/matresa/about.html
Anmerkungen	-

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

Modulverantwortung	Iris Lewandowski
Bezug zu anderen Modulen	This module provides the basic knowledge on agricultural production of biobased resources that is needed to accomplish the Master Programme in Bioeconomy.
Teilnahmevoraussetzung	See admission regulations for the Master Programme Bioeconomy.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 semester
Studiengänge	Biobased Products and Bioenergy (Master) 3. Semester, elective Bioeconomy (Master) 1. Semester, semi-elective Earth and Climate System Science (Master), 1. Semester, compulsory
Prüfungsdauer (in Minuten)	60
Präsenzstudium (in Stunden)	52
Selbststudium (in Stunden)	128
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	Students have a sound knowledge of crop 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 and their important links to livestock production. 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, scientific writing, team work and interdisciplinary collaboration.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: approx. 55. Prioritiy will be given to students for whom the module is compulsory.
Modulprüfung und Gewichtung	50% written exam
Studienleistung und Gewichtung	25% case study presentation including discussion, 25% case study written report
Agricultural Production of Biobased Resources (3403-431)	
Person(en) verantwortlich	Iris Lewandowski Regina Birner
Lehrform	Vorlesung
SWS	4
Inhalt	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 / hidden agricultural value chains; º Bio-physical principles of agricultural production; º Role of climate and climate change in agricultural production. • º Systematics, description and analysis of agricultural production systems in different agro-ecological regions; º Case studies in crop 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.
Literatur	https://link.springer.com/book/10.1007%2F978-3-319-68152-8

Anmerkungen	Limited number of participants (approx. 55) due to intensive supervision of presentations.

Modul: Computational Thinking (1511-400)

Modulverantwortung	Christian Krupitzer
Bezug zu anderen Modulen	No previous knowledge is expected for this module.
Teilnahmevoraussetzung	
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	M.Sc. Food Biotechnology, 3. Semester, Wahl M.Sc. Food Science and Engineering, 3. Semester, Wahl M.Sc. Lebensmittelchemie, 3. Semester, Wahl M.Sc. Food Systems, 3. Semester, Wahl M.Sc. Bioeconomy, 3. Semester, Wahl (Profil: Transforming Food Systems | Data Science and Artificial Intelligence)
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	63
Selbststudium (in Stunden)	162
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	This module will provide essential knowledge of the technological foundations of information systems. Based on this, students will be able to assess technology but also to develop software and acquire fundamentals for learning machine learning techniques. The students will learn basic concepts of computer hardware (von Neumann architecture) and system software (operating systems concepts), programming fundamentals (Java or Python), as well as algorithms and data structures (searching, sorting, lists, hash-tables, trees). This includes an understanding of the basic architectures of modern information systems, software implementation, and how to model problems in algorithms/software and how solve them using modern programming languages.
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	Written examination: 100%

Studienleistung und Gewichtung	-
Computational Thinking (1511-401)	
Person(en) verantwortlich	Christian Krupitzer
Lehrform	Vorlesung mit Übung
SWS	6
Inhalt	The students will learn basic concepts of computer hardware (von Neumann architecture) and system software (operating systems concepts), programming fundamentals (Java or Python), as well as algorithms and data structures (searching, sorting, lists, hash-tables, trees). This includes an understanding of the basic architectures of modern information systems, software implementation, and how to model problems in algorithms/software and how solve them using modern programming languages.
Literatur	List of English literature will be provided at start of course.
Anmerkungen	No previous knowledge is expected for this module.

Modul: Current Topics in Food Material Sciences (1507-630)

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	1 Semester
Studiengänge	M.Sc. Agrarbiologie, 3. Semester, Wahl M.Sc. Lebensmittelchemie, 3. Semester, Wahl M.Sc. Food Systems, 1. Semester, Wahl M.Sc. Food Science and Engineering, 3. Semester Wahl
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The aim of the module is that the students are able to … - to understand and solve problems in the field of food materials science. - to work out experimental design and conception based on a research question in the field of food material science. - to be able to carry out practical, scientific work in the laboratory and pilot plant. - to evaluate and present scientific results.
empfohlene Vorkenntnisse	-
Anmerkungen	Anzahl Teilnehmerplätze: 15 Anmeldung zum Modul: ILIAS Anmeldezeitraum: bis 4 Wochen vor Modulbeginn Kriterien, nach denen Studienplätze vergeben werden: Reihenfolge der Anmeldung
Modulprüfung und Gewichtung	protocol and oral presentation
Studienleistung und Gewichtung	-

Current Topics in Food Material Sciences (1507-631)	
Person(en) verantwortlich	Jochen Weiss
Lehrform	Seminar mit Übung
SWS	4
Inhalt	Design, performance, evaluation, and interpretation of real scientific experiments in current food materials science research projects under the guidance of an experienced scientist.
Literatur	Will be announced during the course.
Anmerkungen	-

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

Modulverantwortung	Reinhard Kohlus
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Knowledge of equivalent to Food Process Design I, e.g. Basics of fluid mechanics, mass and heat transfer, unit operations in food processing.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 4)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Food Systems (Master, PO vom 01.10.2019) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	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.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 20 Registration via ILIAS until 2 weeks before the course starts.
Modulprüfung und Gewichtung	Written exam (60 minutes), oral exam (30 minutes).
Studienleistung und Gewichtung	-

Drying, Granulation and Instantisation (1503-541)

Person(en) verantwortlich	Reinhard Kohlus
Lehrform	Vorlesung mit Praktikum
SWS	4
Inhalt	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.
Literatur	Trocknungstechnik in der Lebensmittelindustrie , Gehrmann, Esper, Schuchmann, Behrs-Verlag 2009; Die wissenschaftlichen Grundlagen der Trocknungstechnik Band 1, , O. Krischer, W. Kast Springer Verlag 1992
Anmerkungen	List of English literature will be provided at start of course

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

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	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.
Teilnahmevoraussetzung	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”.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	Food Systems (Master, PO vom 01.10.2019) 3. Semester, Pflicht
Prüfungsdauer (in Minuten)	20
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	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
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	60% Case Study + 40% Pitch
Studienleistung und Gewichtung	-
Emerging Technologies Business Case Study (1507-461)	
Person(en) verantwortlich	Jochen Weiss
Lehrform	Vorlesung mit Seminar
SWS	5
Inhalt	- 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
Literatur	-
Anmerkungen	-

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

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Admission to a Master's program of Food Science & Engineering or the Doctoral degree program at the Faculty of Natural Sciences. This advanced module requires basic knowledge of food structures.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 3)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 3. Semester, Wahl Promotionsstudiengang Naturwissenschaften (Promotionsstudiengänge, PO vom 14.02.2015) 1. Semester, Wahl Food Systems (Master, PO vom 01.10.2019) 1. Semester, Wahl
Prüfungsdauer (in Minuten)	20
Präsenzstudium (in Stunden)	70
Selbststudium (in Stunden)	155
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Upon completion of this (partly online) 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 physicochemical 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.

	Furthermore, 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 required to demonstrate their critical and analytical thinking skills by asking critical questions during the student presentations of other students' assignments. Students are able to improve their written and oral English skills.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 16 Sign-up for module: in Ilias. The places in the module are given as „First come, first served basis". Some parts of the module may be held online as synchronous and/or asynchronous learning elements.
Modulprüfung und Gewichtung	Oral exam (75%). Development project and its presentation (25%).
Studienleistung und Gewichtung	Laboratory work, Presentation of laboratory work.
Encapsulation of Functional Food Components with Excercises (1507-411)	
Person(en) verantwortlich	Jochen Weiss
Lehrform	Vorlesung mit Übung und Praktikum
SWS	4
Inhalt	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 indus-tries. 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 assingments will be also orally presented during the module.
Literatur	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
Anmerkungen	Maximum number of participants: 12 Basic knowledge in food structures required

Modul: Entrepreneurship and Innovation in the Food System (1507-470)

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	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.
Teilnahmevoraussetzung	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
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 1)
Studiengänge	Food Systems (Master, PO vom 01.10.2019) 2. Semester, Pflicht
Prüfungsdauer (in Minuten)	30
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	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
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	60% Case Study 40 % Pitch
Studienleistung und Gewichtung	-
Summer School: Entrepreneurship and Innovation in the Food System (1507-471)	
Person(en) verantwortlich	Jochen Weiss Maarten Kamp

Lehrform	Vorlesung mit Übung
SWS	-
Inhalt	Teaching and practice related to - design thinking, - ideas generation, - financing, - Intellectual Property - project management - business models - business plan development.
Literatur	-
Anmerkungen	The Summer School will be delivered using the innovative teaching methods based on the flipped classroom concept.

Modul: Food, Consumer and Innovation (Aarhus 1)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Food Microbiology (1501-440)

Modulverantwortung	Herbert Schmidt
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Bachelor's degree in a natural science degree programme in Life Sciences
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 1)
Studiengänge	M.Sc. Food Biotechnology (1. Semester, Pflicht)
Prüfungsdauer (in Minuten)	45
Präsenzstudium (in Stunden)	96
Selbststudium (in Stunden)	129
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The aim of the module is that upon completion students will be able to - understand and explain basic principles of scientific operation - present various principles of diagnostics and taxonomy of food-associated microorganisms - conceptualise, prepare and discuss presentations in microbiology based on original publications - discuss and apply new experimental, analytical methods in the field of food microbiology - independently plan, prepare and carry out practical laboratory experiments in the field of isolation and characterisation of lactic acid bacteria from fermented milk products. - understand and apply laboratory record keeping and scientific documentation. - apply bioinformatic sequence analysis of 16S rRNA genes. - understand and discuss ethical principles in science. - work independently and acquire knowledge

	- read and discuss technical literature critically - use technical terms correctly - use scientific terminology - plan, carry out and evaluate laboratory experiments independently - evaluate own results against the background of the scientific literature. - apply the acquired knowledge in an interdisciplinary manner - apply communication and cooperation skills
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 24 Registration: via ILIAS Criteria according to which places are allocated: Registration within the registration period, study course
Modulprüfung und Gewichtung	Protocol / seminar presentation / poster (All three performances must be completed. The module is ungraded)
Studienleistung und Gewichtung	-
Food Microbiology - Laboratory Course and Documentation (1501-441)	
Person(en) verantwortlich	Herbert Schmidt
Lehrform	Vorlesung mit Seminar und Laborübungen
SWS	6
Inhalt	- Microbial starter cultures: taxonomy, fermentation, metabolism and genetics - Literature databases - Documentation and presentation tools - Preparation of culture media, solutions and buffer - Isolation and characterization of lactic acid bacteria from fermented dairy products

	- Identification by 16S rRNA PCR and DNA sequencing - Bioinformatic analysis of DNA sequences
Literatur	Hutkins, Robert W., 2006. Microbiology and Technology of Fermented Foods. IFT Press, Blackwell Publishing, 2121 State Avenue, Ames, Iowa 50014, USA, 1st Edition.
Anmerkungen	-

Modul: Food Process Design I - Efficient Processing and Transport Phenomena (1503-520)

Modulverantwortung	Reinhard Kohlus
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Technical basics, process engineering, physical chemistry or thermody-namics of multiphase systems
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 3)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 1. Semester, Pflicht Bioeconomy (Master, PO vom 01.10.2014) 3. Semester, Wahl (Profil: Transforming Food Systems) Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 3. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 3. Semester, Wahl Bioeconomy (ab WS 16/17) (Master, PO vom 01.04.2017) 3. Semester, Wahl Food Systems (Master, PO 01.10.2019) 1. Sem., Wahl
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	80
Selbststudium (in Stunden)	145
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The students know the fundamentals of thermal separation processes. They are capable of applying physical-chemistry fundamentals, to design the processes. The laws of energy and mass and momentum transfer are known and can be applied to standard problems. The fundamental calculation methods are mastered.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 50

Modulprüfung und Gewichtung	oral exam (20 minutes), optional written exam (120 minutes)
Studienleistung und Gewichtung	-
Food Process Design I - Efficient Processing and Transport Phenomena (1503-521)	
Person(en) verantwortlich	Reinhard Kohlus
Lehrform	Vorlesung mit Übung
SWS	6
Inhalt	Lecture: Application of the fundamentals of thermal separation processes, multiphase flow and food process design. Specifically covered topics are drying technology, distillation and rectification, extraction, crystallization, heat transfer processes. Fundamentals: Equilibria equations, Phase and state diagrams, mass transfer equations, Multiphase flows: especially gas –liquid flows, Mass transfer in multiphase systems, two film theory, surface renewance theory Design of rectification system: McCabe Thiele Diagram, hydrodynamic design of rectification columns. Description of residence time distributions, prediction of RTD's Drying, coupling of heat and mass transfer, Glass transition temperature, sorp-tion isotherms. Optimisation of energy requirements, coupling of heat flows- Design and decision taking of heat transfer systems. Exercises and problems in the above given areas will be covered using calcu-lation and engineering software.
Literatur	Sattler; Thermische Trennverfahren; VCH Verlag Kraume, Kraume, M: Transportvorgänge in der Verfahrenstechnik, Grundlagen und Apparative Umsetzung , Springer Verlag 2004
Anmerkungen	-

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

Modulverantwortung	Reinhard Kohlus
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Knowledge of equivalent to Food Process Design I, e.g. Basics of fluid mechanics, mass and heat transfer, unit operations in food processing.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 3)
Studiengänge	Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Food Systems (Master, PO vom 01.10.2019) 2. Semester, Wahl Bioeconomy (Master), 2. Semester, Wahl (Profil: Transforming Food Systems within the Bioeconomy)
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	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.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 24 Registration via ILIAS
Modulprüfung und Gewichtung	oral exam (20 minutes), optional written exam (120 minutes)
Studienleistung und Gewichtung	-
Food Process Design II - Process Integration and Scale up (1503-501)	
Person(en) verantwortlich	Reinhard Kohlus
Lehrform	Vorlesung mit Übung
SWS	5
Inhalt	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.
Literatur	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)
Anmerkungen	List of English literature will be provided at start of course

Modul: Food Product Development: From Concept Ideation to Product Launch (1507-520)

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Student of one of the above mentioned Master programes with good command in English language
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 4)
Studiengänge	M.Sc. Food Systems, 1./3. Semester, Wahl M.Sc. Bioeconomy, 3. Semester, Wahl Profil: Transforming Food Systems M.Sc. Food Biotechnology, 3. Semester, Wahl M.Sc. Food Science & Engineering, 3. Semester, Wahl M.Sc. Lebensmittelchemie, 3. Semester, Wahl M.Sc. Molekulare Ernährungswissenschaft, 3. Semester, Wahl M.Sc. Molekulare Ernährungswissenschaft (ab Studienbeginn WS 23/24), 3. Semester, Wahl M.Sc. Ernährungsmedizin, 3. Semester, Wahl M.Sc. Medizinische Ernährungswissenschaft, 3. Semester, Wahl
Prüfungsdauer (in Minuten)	60
Präsenzstudium (in Stunden)	70
Selbststudium (in Stunden)	155
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Students will also be able to identify and respond to market needs based on a basic understanding on. Holistic insights food product development and business creation into this topic will give them the tools to critically assess tasks in the field of product development and improvement, as well as entrepreneurial challenges to bring products to the market. This will allow them to develop leadership qualities and to work together as a team. Furthermore they will know technical terms and prerequisites related to these fields.
empfohlene Vorkenntnisse	-
Anmerkungen	Number of participants: 20

	Registration via ILIAS (4 weeks before module start) Place allocation: Eligibility and registration order in ILIAS Please note: In winter semester, this module is offered as a block (1507-521). In summer semester, this module is offered during the whole semester (1507-522).
Modulprüfung und Gewichtung	written business case (60%) and oral presentation (40%)
Studienleistung und Gewichtung	-
Food Product Development: From Concept Ideation to Product Launch (1507-521)	
Person(en) verantwortlich	Lisa Berger Jochen Weiss
Lehrform	Vorlesung
SWS	4
Inhalt	The module will cover different topic areas, such as: - Ideation in Start-Ups (conceptualization; start-up hub & entrepreneurial spirit) - Current Trends (market analysis, market trends, consumer trends) - Applied Product Development (emerging materials, emerging technologies, labelling & claims, sensory analysis, case studies, food safety, legal assessments and IP, challenges) - Corporate Identity (brand development, PR & marketing) - Innovations in Packaging (packaging materials science, packaging trends) - External Demands on Start-Ups (investment, targeting the retail) - Start-Up Case Studies (pre-seed, seed invest, invested & scaled, established businesses)
Literatur	Will be provided during the module

Anmerkungen	In winter semester, this module is offered as a block. In summer semester, this module is offered during the whole semester.

Modul: Food Product Re-formulation (Reading 2)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	
ECTS	10
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	for detailed information on this module, please check FBMPRE-Food Product Reformulation
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Food Quality and Technology (Aarhus 5)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Food Safety Management Systems (Turin 5)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Food Structure and Enzymes (Aarhus 4)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Food Toxicology (Turin 6)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Free Project Work (1500-020)

Modulverantwortung	Lutz Fischer
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	M.Sc. Food Biotechnology
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	n. V.
Studiengänge	Food Biotechnology (Master, PO vom 01.10.2016) 2./3. Semester, Wahl Food Systems (Master, PO vom 01.10.2019) 1. Semester, Wahl
Prüfungsdauer (in Minuten)	30
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	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
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 3 Students have to find a professor to supervise the project.
Modulprüfung und Gewichtung	Report (50%) and Presentation (50%)
Studienleistung und Gewichtung	-

Free Project Work (1500-021)

Person(en) verantwortlich	Mario Jekle Herbert Schmidt Jochen Weiss Lutz Fischer

	Jörg Hinrichs Reinhard Kohlus Rudolf Hausmann Yanyan Zhang Monika Gibis Viktoria Zettel Christian Krupitzer Alexander Schaum
Lehrform	Projekt/Projektarbeit
SWS	-
Inhalt	-
Literatur	-
Anmerkungen	-

Modul: Functional Compounds and Nutrition (Turin 7)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Functional Food Compounds: Food Processing Application (Turin 2)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Functional Food Compounds: Nutritional Aspects (Turin 1)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Functional Food Compounds: Types and Processing Technologies to obtain them (Turin 3)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Functional Foods: Design and Validation (Madrid 3)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	for detailed information on this module, please check Functional ingredientes: design and validation / Ingredientes funcionales: diseño y validación
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Function Compounds Applied to Food Processes (Turin 8)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Future animal-based Food (Aarhus 2)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

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

Modulverantwortung	Claudia Bieling
Bezug zu anderen Modulen	This module is of particular interest for students who intend to choose the module "Ethical Reflection on Food and Agriculture" and other modules in the field of social sciences.
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 semester
Studiengänge	Organic Agriculture and Food Systems (Master) 2. Semester, compulsory Earth System Science (Master) 4. Semester, elective Earth and Climate System Science (Master) 4. Semester, elective Bioeconomy (Master) 2. Semester, elective (profile: Sustainable biomass production systems | Transforming food systems within the Bioeconomy)
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	In this course, students are provided with the conceptual tools (most importantly: Food Regime Theory, Food Systems) to understand the sociological bases around which a future world of agriculture, food and broader land use will possibly take shape. 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). 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 oral exam (video production), while writing their essay (written paper), peer-reviewing an essay of a fellow student and preparing and following up on the seminar, studetns practice self-reliance, time management and team work. 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).
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	Written paper (essay 50 %)
Studienleistung und Gewichtung	Video production: 40%, Peer review: 10%
Global Challenges & Local Answers – Approaches for Sustainable Human-Nature-Relations (4302-461)	
Person(en) verantwortlich	Claudia Bieling
Lehrform	Vorlesung
SWS	2
Inhalt	Land Grabbing, soil desertification, precarization of rural livelihoods, and rising global inequality – these are just some examples that show the challenges of today's agriculture and food systems. In this module, we want to undertake a historical and geographical journey to learn more about the roots of these problematics and to discover some 'bright spots' in different regions that show that more sustainable forms of agriculture and land-use are possible. In the first section of the module, students will acquire knowledge on two different theoretical approaches to viewing food systems and their challenges (and solutions) – food regime theory and food systems thinking. Food regime theory offers a historical and global overview of the making of the current agri-food system, as well as the new and emerging social movements that search for more sustainable and just proposals. Parting from theoretical perspectives of political economy and

	political ecology, we analyze the historical phases of food regimes and their colonial embeddedness in the 18th, 19th, and 20th century. Students will gain an inside-view into food regime theory and learn how to connect it with current problematics of the global agri-food system, such as the industrialization of food production and unequal world trade dynamics. Food systems thinking, instead, provides a framework that allows to better describe, understand and analyze complex systems and their non-linear behaviors, fuzzy boundaries and feedback loops. By helping to better understand the relationships between food, humans and the natural environment, food systems theory can help unveil unexpected feedbacks, unsustainable lock-ins, as well as potential leverage points for the sustainable transformation of these systems.
Literatur	-
Anmerkungen	-

Past and future of food systems: perspectives of political economy (4302-462)	
Person(en) verantwortlich	Claudia Bieling
Lehrform	Seminar
SWS	2
Inhalt	After the introduction into Food Regime Theory and Food Systems Thinking, the second section of the module offers insights into social movements that are developing alternative visions to transform the global agri-food system. The focus will be on approaches of Organic Farming, Agroecology, Food Sovereignty, Alternative Food Networks (AFN), and the Food Justice movement. We want to analyse these approaches from a conceptual point of view, considering intersectional and postcolonial perspectives, and discussing ethical dilemmas, such as the tension between institutionalization, commercialization by labelling and strengthening transformative potentials. In the final discussion on Food Futures we will reflect upon questions on what these proposals could mean for transitions towards sustainable development on different scales, regarding global debates (e.g. Sustainable Development Goals), as well as the relevance for our society, region and daily life as students.
Literatur	Course-relevant readings will be made available or uploaded in ILIAS if possible.
Anmerkungen	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.
Tutorial Global Agri-food Systems: Conventional, Organic, and Beyond (freiwillig) (4302-463)	
Person(en) verantwortlich	Claudia Bieling
Lehrform	Tutorium
SWS	2
Inhalt	-
Literatur	-
Anmerkungen	-

Modul: Global Nutrition and Food Security (1403-400)

Modulverantwortung	Jan Frank
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Basic knowledge of nutrition physiology (macro- and micronutrients: biochemical function and requirements) is assumed.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester (Block 4)
Studiengänge	M.Sc. Molekulare Ernährungswissenschaft, 3. Semester (Wahl) M.Sc. Molekulare Ernährungswissenschaft (ab Studienbeginn WS 23/24), 3. Semester, Wahl M.Sc. Ernährungsmedizin, 3. Semester, Wahl M.Sc. Medizinische Ernährungswissenschaft, 3. Semester, Wahl M.Sc. Food Science and Engineering, 3. Semester, Wahl M.Sc. Food Biotechnology, 3. Semester, Wahl M.Sc. Lebensmittelchemie, 3. Semester, Wahl M.Sc. Food Systems, 3. Semester, Wahl
Prüfungsdauer (in Minuten)	60
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Students can explain the framework of Food and Nutrition Security and the drivers of food insecurity. They are familiar with the nutrition situation of developing and industrialized countries and with the problems of nutrition transition. They can analyze the complexity of the interrelationship between nutrition and health in particular in the case of vulnerable groups such as pregnant women, breastfeeding mothers, children and elderly. They will be able to assess food intake and measure nutritional status, taking into account the role of food analyses. Strategies to improve nutrient intake by both food-based and non-food based approached, their limitations and how these differ between developing

	and industrialized countries are finally known by the students.
empfohlene Vorkenntnisse	-
Anmerkungen	Number of participants: 50 Registration for the module: ILIAS Registration period: 1.4. to 1 week before the start of the module Criteria according to which places are allocated: Order of registration.
Modulprüfung und Gewichtung	Written Exam (70%) and Presentation (30%)
Studienleistung und Gewichtung	Regular and active participation
Global Nutrition and Food Security (1403-401)	
Person(en) verantwortlich	Jan Frank
Lehrform	Vorlesung
SWS	4
Inhalt	This module will provide a basic oversight as to the state of global nutrition and food security and how it is assessed: dietary and anthropometric assessment, biomarkers of nutritional status and food security. The direct and indirect causes of malnutrition and food insecurity will be evaluated as well as the food based and non-food based strategies available to address these. The emerging health crisis of the double burden of malnutrition, together with nutritional transitions will be evaluated. The risks with regard to malnutrition and food insecurity for vulnerable groups such as pregnant and lactating women and refugees will be evaluated. The important roles of agricultural development, climate change and gender equality in global nutrition and food security will be discussed. Special attention will also be paid to the differences between developed and developing countries in the risks factors, vulnerable populations and appropriate strategies to address malnutrition and food insecurity.
Literatur	Development Initiatives, 2020. Global Nutrition Report 2020: Action on equity to end malnutrition, Bristol, UK: Development Initiative. Development Initiatives, 2018. Global Nutrition Report 2018: Shining a light to spur action on nutrition, Bristol, UK: Development Initiative.

	GBD 2017 Diet Collaborators. “Health effects of dietary risks in 195 countries, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017.” Lancet (London, England) vol. 393,10184 (2019): 1958-1972. https://www.thelancet.com/article/S0140-6736(19)30041-8/fulltext FAO, IFAD, UNICEF, WFP and WHO. 2020. The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets. Rome, FAO. https://doi.org/10.4060/ca9692en FAO, IFAD, UNICEF, WFP and WHO. 2019. The State of Food Security and Nutrition in the World 2019. Safeguarding against economic slowdowns and downturns. Rome, FAO. https://www.wfp.org/publications/2019-state-food-security-and-nutrition-world-sofi-safeguarding-against-economic
Anmerkungen	Ansprechpartner für diese Veranstaltung ist Herr Stütz (wolfgang.stuetz@uni-hohenheim.de)

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

Modulverantwortung	Roland Gerhards
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	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.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	alle 2 Jahre
Dauer des Moduls	1 semester with a blocked part
Studiengänge	Crop Sciences - Plant Nutrition and Protection (Master) 2. Semester, elective Agricultural Sciences - Major: Crop Production Systems (Master) 2. Semester, elective Food Systems (Master) 2. Semester, elective
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	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.

empfohlene Vorkenntnisse	-
Anmerkungen	For the block course "Ihinger Hof", a special registration is needed.
Modulprüfung und Gewichtung	Written exam (70%)
Studienleistung und Gewichtung	Two presentations with discussion (15% each)
Sensor Technologies for Plant Protection (3602-461)	
Person(en) verantwortlich	Roland Gerhards
Lehrform	Vorlesung
SWS	1
Inhalt	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.
Literatur	Will be presented during the lecture.
Anmerkungen	-
Application Technologies and Expert Systems in Weed Management with Exercises (3602-462)	
Person(en) verantwortlich	Roland Gerhards
Lehrform	Seminar mit Übung
SWS	3
Inhalt	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.
Literatur	Will be presented during the course.
Anmerkungen	The course will take place at the Research Station Ihinger Hof. 5 days in June from 9 a.m. to 4 p.m. Students will get accommodation and food at Ihinger Hof. For more information and

	registration: www.euroleague-study.org/en/information_technologies

Modul: Innovative and Organic Production of Fruits and Vegetables (Aarhus 3)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	8
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Innovative Technologien für Milchprodukte und pflanzliche Alternativen (1505-520)

Modulverantwortung	Jörg Hinrichs
Bezug zu anderen Modulen	Das Modul ergänzt analytisch und verfahrenstechnisch orientierte Module und setzt sich insbesondere mit der Erforschung und Entwicklung neuer Ideen und Strategie zur Nachhaltigkeit, Ernährung, neuen Rohstoffen und Umweltfragen auseinander.
Teilnahmevoraussetzung	Grundlagen in Mikrobiologie, Chemie, Physik
Lehrsprache	deutsch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester (1. Block)
Studiengänge	M.Sc. Food Biotechnology, 3. Semester, Wahl M.Sc. Food Science and Engineering, 3. Semester, Wahl M.Sc. Food Systems, 3. Semester, Wahl M.Sc. Lebensmittelchemie, 3. Semester, Wahl
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	70
Selbststudium (in Stunden)	155
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Ziel des Moduls ist, dass die Studierenden nach dessen Abschluss in der Lage sind, wissenschaftliche Publikationen zu neuen Themen zu suchen, einzuordnen und zu bewerten. Sie sind in der Lage, neue Fragestellungen z. B. hinsichtlich Nachhaltigkeit, neuer Rohstoffe in Verbindung z. B. mit adressierter Produktfunktionalität zu strukturieren. Sie gewinnen Kompetenz in der Anwendung von Unit Operations zur Verarbeitung innovativer Lebensmittelprodukte und der Auswahl von physikalischen, chemischen und mikrobiologischen Methoden zur quantitativen oder qualitativen Bewertung von Zielparametern. Sie sind in der Lage, im Team Potenziale für neue Verfahren oder Produkte aus wissenschaftlicher Sicht zu identifizieren, Hypothesen zu formulieren und Verarbeitungswege zu postulieren. Daraus abgeleitet sind Forschungs- und daraus abgeleitete Entwicklungsideen im Team kurz und prägnant schriftlich zusammenzustellen, zu diskutieren und zu präsentieren.

	Dieses Modul dient zudem der Einführung in die selbstständige Durchführung eines Forschungsprojektes und bereitet auf die Bearbeitung der Masterarbeit vor. Verfassen eines Manuskripts unter Verwendung der einschlägigen wissenschaftlichen Literatur zum Thema (10-15 Seiten). Diese Arbeit wird eingereicht und mit dem Betreuer besprochen und ggf. zur Publikation in einem Journal vorbereitet.
empfohlene Vorkenntnisse	-
Anmerkungen	Anzahl Teilnehmerplätze: 10 Anmeldung zum Modul: Beginn WS über ILIAS Kriterien, nach denen Studienplätze vergeben werden: First in Studierende, die eine ansteckende Krankheit nach Bundesseuchengesetz haben, dürfen nicht teilnehmen! Die Teilnahme an den Experimenten im Technikum der For-schungs- und Lehrmolkerei Hohenheim ist nur zulässig mit entsprechender Schutzkleidung.
Modulprüfung und Gewichtung	Mitarbeit im Seminar und in den praktischen Übungen; ausgearbeitetes Manuskript
Studienleistung und Gewichtung	schriftlicher Bericht
Innovative Technologien (1505-521)	
Person(en) verantwortlich	Jörg Hinrichs
Lehrform	Vorlesung
SWS	-
Inhalt	In diesem Modul werden Fähigkeiten und Fähigkeiten vermittelt, um die Abfolge von Unit-Operations im Hinblick auf die Prozess-Struktur-Funktions Beziehungen für Milchprodukte und pflanzliche Alternativen zu analysieren. Sie lernen neue und alternative Prozesse in Forschung und Entwicklung kennen anhand von Beispielen aus der aktuellen Forschung. Präsentiert werden ausgewählte, ständig aktualisierte Topics aus dem wissenschaftlichen Bereich und wirtschaftlichen Umfeld der Verarbeitung von

	Milch und deren Alternativen. Gewährt werden Einblicke in die Beantragung und Durchführung von Forschungsprojekten.
Literatur	Wissenschaftliche Literatur, Dissertationen, Veröffentlichungen des Fachgebiets, Lehrbücher in der Fachbereichsbibliothek.
Anmerkungen	-
Projektplanung und experimentelles Arbeiten (1505-522)	
Person(en) verantwortlich	Jörg Hinrichs
Lehrform	Seminar
SWS	1
Inhalt	Die Studierenden analysieren aktuelle Themen aus dem Bereich der nachhaltigen Lebensmittelverarbeitung auf der Basis von Natur- und Ingenieurwissenschaften. Die Auswahl des Themas erfolgt in Absprache mit dem Betreuer. Mit Unterstützung des Betreuers beschreiben, analysieren und identifizieren die Studierenden Lücken auf der Grundlage einer Literaturrecherche. Abschließend werden Forschungs- und Entwicklungsfragen diskutiert und in Manuskriptform formuliert. Folgende Methoden und Instrumente werden für die Analyse verwendet: - Literaturrecherche - Zusammenstellung und Einordnung von Daten und Erkenntnissen aus der Literatur. - Verfassen von wissenschaftlichen Texten und Erstellen von aussagekräftigen Bildern und Tabellen.
Literatur	Wissenschaftliche Literatur, Dissertationen, Veröffentlichungen des Fachgebiets, Lehrbücher in der Fachbereichsbibliothek.
Anmerkungen	-
Innovative Technologien und Analysen – Praktische Übungen (1505-523)	
Person(en) verantwortlich	Jörg Hinrichs
Lehrform	Praktische Übung

SWS	2
Inhalt	In diesem Modul werden Fähigkeiten und Fähigkeiten vermittelt, um die Abfolge von Unit-Operations im Hinblick auf die Prozess-Struktur-Funktions Beziehungen zu analysieren. Sie lernen neue und alternative Prozesse in Forschung und Entwicklung kennen anhand von Beispielen aus der aktuellen Forschung. Theoretische Übungen und experimentelle Arbeiten im Rahmen von Projekten unter Nutzung von Pilotanlagen und spezifischen Analysen.
Literatur	Dissertationen, Aktuelle Veröffentlichungen des Fachgebiets
Anmerkungen	-

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

Modulverantwortung	Rudolf Hausmann
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 3)
Studiengänge	Biologie (Master, PO vom 01.10.2010) 3. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 3. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 3. Semester, Wahl Bioeconomy (Master, PO vom 01.10.2014) 3. Semester, Wahl Promotionsstudiengang Naturwissenschaften (Promotionsstudiengänge, PO vom 14.02.2015) 1. Semester, Wahl Bioeconomy (ab WS 16/17) (Master, PO vom 01.04.2017) 3. Semester, Wahl
Prüfungsdauer (in Minuten)	20
Präsenzstudium (in Stunden)	90
Selbststudium (in Stunden)	135
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	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 experienced and adapted to an interdisciplinary field. - have enhanced their scientific written and verbal skills.
empfohlene Vorkenntnisse	-
Anmerkungen	Available places: 12

	Registration for module via ILIAS Criteria for admission is granted: Mostly after first-served basis.
Modulprüfung und Gewichtung	seminar presentation (25%), oral exam (75%)
Studienleistung und Gewichtung	Regular and active participation in the online lecture, the lecture, the exercises and the holding of a seminar talk
Integrated Bioprocess Engineering Bioseparation Process Science (Downstream Processing) (1510-431)	
Person(en) verantwortlich	Rudolf Hausmann
Lehrform	Vorlesung mit Seminar und Praktikum
SWS	4
Inhalt	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) Summery.
Literatur	R. G. Harrison, P. Todd, S. R. Rudge, D. P. Petrides (2003): Bioseparations Science and Engineering, Oxford University Press
Anmerkungen	-

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

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	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.
Lehrsprache	deutsch/englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	1 Semester
Studiengänge	Food Systems (Master, PO vom 01.10.2019) 1. Semester, Wahl
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	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

empfohlene Vorkenntnisse	-
Anmerkungen	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.
Modulprüfung und Gewichtung	schriftlicher Bericht Praktikumsbericht ---------- Written report Internship report
Studienleistung und Gewichtung	-
Internship FS (Industrial placement) (1507-421)	
Person(en) verantwortlich	N.N.
Lehrform	Praktikum
SWS	-
Inhalt	-
Literatur	-
Anmerkungen	-

Modul: Introduction to Food Systems (1507-440)

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	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.
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	4 Wochen (Block 1)
Studiengänge	Food Systems (Master, PO vom 01.10.2019) 1. Semester, Pflicht
Prüfungsdauer (in Minuten)	90
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	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
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	20 % essay (2-3 pages) + 80 % report (20-30 pages)
Studienleistung und Gewichtung	-
Introduction to Food Systems (1507-441)	
Person(en) verantwortlich	Jochen Weiss
Lehrform	E-Learning
SWS	4
Inhalt	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.
Literatur	-
Anmerkungen	-

Modul: Introduction to Machine Learning in Python (4407-480)

Modulverantwortung	Christian Krupitzer Anthony Stein
Bezug zu anderen Modulen	The module provides basic knowledge on machine learning that well prepare the students for participation in subsequent AI modules, i.e., 4407-440 "Einführung in die Künstliche Intelligenz", 4407-470 "Artificial Intelligence for Agriculture", 4407-490 "Bildanalyse mit Deep Learning" or 4407-810 "Machine Learning Reading Club".
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester
Studiengänge	Agrarwissenschaften - Agrartechnik (Master), 2. Semester, semi-elective All Master's programs of the Faculty of Agricultural and Natural Sciences, 2. semester, elective Information Systems (Master), elective Bioeconomy (Master), 2. Semester, elective (Profil: Data Science and Artificial Intelligence)
Prüfungsdauer (in Minuten)	90
Präsenzstudium (in Stunden)	0
Selbststudium (in Stunden)	225
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	After completing this module, students are able to critically assess the performance of different machine learning approaches and to choose the best approach for a specific use case. Therefore, this module will provide essential theoretical knowledge of the foundations of programming in Python and machine learning algorithms and approaches.Further, students acquire practically-applicable knowledge how to apply machine learning to solve real world problems. The online format, regular assignments as well as the self-study character of the module supports the students' organizational skills and trains their ability to work independently. Further, the module supports analytical thinking, i.e., how to structure a problem and find appropriate solutions to it by means

	of machine learning. Since the course materials and the teaching language are completely in English, the students further train their foreign language skills.
empfohlene Vorkenntnisse	Module 4407-480 is a Master's program module, but can already be taken as an elective in Bachelor's degree programs in agricultural sciences. No prior programming skills are assumed. The necessary basic concepts of Python programming are taught in the first third of the course. In order to prepare for later AI modules in the Master's programs, it is recommended to take this course already during the specialization phase in the Bachelor's programs.
Anmerkungen	The maximum number of participants is limited to a semester-specific amount. In case the threshold is exceeded, a waiting list will be maintained.
Modulprüfung und Gewichtung	Computer-based online exam (50%)
Studienleistung und Gewichtung	Integrated online quizzes and programming assignments to be solved individually by the students (50%)
Introduction to Machine Learning in Python (4407-481)	
Person(en) verantwortlich	Anthony Stein Christian Krupitzer
Lehrform	E-Learning
SWS	5
Inhalt	-
Literatur	-
Anmerkungen	-

Modul: Irrigation and Drainage Technology (4403-410)

Modulverantwortung	Joachim Müller
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Basic knowledge in soil science, soil tillage and irrigation.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 weeks (block 4)
Studiengänge	Agricultural Sciences in the Tropics and Subtropics (Master) 2. Semester, elective Food Systems (Master) 2. Semester, elective Agricultural Sciences in the Tropics and Subtropics (Master) 2. Semester, elective Environmental Science - Soil, Water, and Biodiversity (Master) 2. Semester, semi-elective in Specialization “Environmental Management” Environmental Science - Soil, Water, and Biodiversity (Master) 2. Semester, semi-elective in Specialization “Soil Resources and Land Use” Environmental Protection and Agricultural Food Production (Master) 2. Semester, semi-elective
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	70
Selbststudium (in Stunden)	155
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	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
empfohlene Vorkenntnisse	-

Anmerkungen	-
Modulprüfung und Gewichtung	Written (100%)
Studienleistung und Gewichtung	-
Irrigation and Drainage Technology (4403-411)	
Person(en) verantwortlich	Joachim Müller
Lehrform	Vorlesung mit Übung und Exkursion
SWS	5
Inhalt	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
Literatur	-
Anmerkungen	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.

Modul: Leadership in Food System (Warsaw 1)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	for detailed information on this module, please check Master in Food Systems
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Lifestyle, Nutrigenetics and Personalised Nutrition (Reading 7)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Management in Food System (Warsaw 3)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	for detailed information on this module, please check Master in Food Systems
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Marketing in Food System (Warsaw 2)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	for detailed information on this module, please check Master in Food Systems
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Masterarbeit (1507-430)

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	mind. 60 ECTS erbrachte Leistung
Lehrsprache	englisch
ECTS	30
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	6 Monate
Studiengänge	Food Systems (Master, PO vom 01.10.2019) 4.Semester, Pflicht
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	900
Lern- und Qualifikationsziele	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
empfohlene Vorkenntnisse	-
Anmerkungen	Registration for the module on an individual basis in consultation with the supervising professor.
Modulprüfung und Gewichtung	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%.
Studienleistung und Gewichtung	-

Modul: Microbes in Health and Disease (Reading 5)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Microbiological Risks in the Food (Turin 4)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Microbiological Safety within the Feed and Food Production Chain (4605-430)

Modulverantwortung	Ludwig Hölzle
Bezug zu anderen Modulen	The knowledge gained by this basic module may be completed in several other more specific modules, especially 4602-430 "Project in advanced Environmental- and Animal Hygiene", 4602-440 "Laboratory Course in Advanced Environmental- and Animal Hygiene".
Teilnahmevoraussetzung	Students shall have basic knowledge in the biochemistry of carbohydrates, fats and proteins as well as in biology and genetics. For better preparation of the students, an introductory lecture is given for those participants who like to fresh up their knowledge before the module starts.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	Environmental Protection and Agricultural Food Production (Master) 1. Semester, compulsory Earth and Climate System Science (Master) 3. Semester, elective Landscape Ecology (Master) 3. Semester, elective Environmental Science - Soil, Water, and Biodiversity (Master) 1. or 3. Semester, elective Agricultural Sciences - Animal Sciences (Master) 3. Semester, elective Agricultural Sciences in the Tropics and Subtropics (Master) 3. Semester, elective Bioeconomy (Master), 3. Semester, elective (Profil: Transforming Food Systems within the Bioeconomy)
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	Students are able to understand and analyse the complex ecologic and microbial systems in soil, air and water as potential epidemiological niches for plant and animal pathogens and zoonotic agents. In addition, students are enabled to perform hygienic risk assessment during microbiocidal biotechnical processes, i.e. composting, anaerobic treatment and

	waste water treatment. In the group with international students they experience the cultural differences in risk assessment and can develop their intercultural competence in this module. Based on these skills and knowledge absolvents are capable to play an important role as advisors in international consultant teams regarding the hygiene of biotechnical processes. critical, analytical thinking , (foreign) language skills
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	oral exam (100 %)
Studienleistung und Gewichtung	-
Microbiological Safety within the Feed and Food Production Chain (4605-431)	
Person(en) verantwortlich	Wolfgang Beyer Ludwig Hölzle
Lehrform	Vorlesung
SWS	4
Inhalt	Principles of microbial morphology and physiology (bacteria, fungi, viruses), life cycles of parasites, microbiology and parasitology of vertebrates, plants, soils, water, and air; survival and inactivation of organisms; techniques for isolation and identification of organisms from soil, water and air. A set of questions will help in exam preparation.
Literatur	• Brock : Biology of Microorganisms, Pearson Education International, Upper Saddle River,NJ07458 • Hurst, Crawford, Knudsen, McInerney, Stetzenbach: Manual of Environmental Microbiology, ASM Press, Washington, DC • Bush, Fernandez, Esch, Seed: Parasitism, Cambridge University Press, Cambridge
Anmerkungen	-

Modul: Molecular Aspects of Plant Protection (3602-450)

Modulverantwortung	Roland Gerhards
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Basics in Botany, Microbiology and Zoology
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	Crop Sciences - Plant Nutrition and Protection (Master) 3. Semester, elective Agricultural Sciences - Major: Crop Production Systems (Master) 3. Semester, semi-elective
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	After successfully completing the module, students can describe the mode of action of pesticides in crop protection including uptake, translocation, molecular action, metabolism and degradation of synthetic and natural pesticides in plants and soils. They can evaluate the evolution of resistance in target organisms against pesticides and assess strategies to overcome resistance. 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 while preparing the scientific project in the exercise. They learn and practice critical and analytical thinking in the lecture and exercise, while generally improving their ability of exploring a scientific subject. While preparing the exercise, students improve their scientific articulateness.
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	Written exam (93%)
Studienleistung und Gewichtung	Written paper in the form of an exercise (7%)
Mode of Action of Herbicides and Herbicide Resistance (3602-451)	

Person(en) verantwortlich	Roland Gerhards
Lehrform	Vorlesung mit Exkursion
SWS	1
Inhalt	This course focuses on chemical weed management. The students will learn about herbicide screening, the uptake, translocation, mode of action, selectivity, metabolism and degradation of herbicides in plants and soils. The mechanisms of herbicide resistance will be explained and strategies will be developed to avoid and overcome herbicide resistance in weed species. A special emphasis is given on GMO-crops with introduced herbicide resistance. Additional excursions to companies developing hercidies and exercises on mode of action and herbicide resistance will be offered.
Literatur	- will be presented in the lecture.
Anmerkungen	-
Mode of Action of Insecticides and Insecticide Resistance (3602-452)	
Person(en) verantwortlich	Georg Petschenka
Lehrform	Vorlesung
SWS	1
Inhalt	The students will learn about the mode of action of insecticides and the evolution of insecticide resistance.
Literatur	-
Anmerkungen	-
Natural Products for Plant Protection (3602-453)	
Person(en) verantwortlich	Roland Gerhards Ralf Vögele Georg Petschenka
Lehrform	Vorlesung
SWS	1
Inhalt	In this course natural products will be introduced that are used or that can potentially be used for plant protection. The products will be studied in terms of toxicity, efficacy against crop pests, stability, metabolism, mode of action and molecular fate in the environment and food chain.
Literatur	Will be presented in the lecture.
Anmerkungen	-
Mode of Action of Fungicides and Fungicide Resistance (3602-454)	

Person(en) verantwortlich	Ralf Vögele
Lehrform	Vorlesung mit Exkursion
SWS	1
Inhalt	The mode of action of fungicides and the evolution of fungicide resistance.
Literatur	-
Anmerkungen	-

Modul: Natural Science Concepts (1507-400)

Modulverantwortung	Christian Krupitzer
Bezug zu anderen Modulen	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
Teilnahmevoraussetzung	See admission regulations for the Master Programme Bioeconomy.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	Bioeconomy (Master, PO vom 01.10.2014) 1. Semester, Wahlpflicht Bioeconomy (ab WS 16/17) (Master, PO vom 01.04.2017) 1. Semester, Wahlpflicht
Prüfungsdauer (in Minuten)	90
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	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.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 45
Modulprüfung und Gewichtung	Written exam (100%)
Studienleistung und Gewichtung	-

Natural Science Concepts (1507-401)

Person(en) verantwortlich	Mario Jekle Walter Vetter Herbert Schmidt Jochen Weiss Lutz Fischer

	Jörg Hinrichs Reinhard Kohlus Christian Krupitzer
Lehrform	Vorlesung
SWS	4
Inhalt	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.
Literatur	-
Anmerkungen	-

Modul: Natural Sources and Green Extraction Technologies to obtain Bioactive Compounds (Turin 9)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Nutrition Communication (Reading 1)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	
ECTS	2,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Nutrition Communication and Professional Practice (Reading 8)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Nutrition Concepts (Reading 6)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Omics Technologies (Madrid 2)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	for detailed information on this module, please check Omics Technologies / Tecnologías ómicas
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Online Dairy Science and Technology (1505-450)

Modulverantwortung	Jörg Hinrichs
Bezug zu anderen Modulen	The module complements analytically or process-engineering oriented modules with the background of processing of milk to sophisticated milk products, e.g. milk concentrates and their application up to powders
Teilnahmevoraussetzung	Scientific background and basics in food microbiology, chemistry, engineering, and soft matter science. Participation at Online Dairy Science and Technology is only possible if 1505-440 has not been accomplished.
Lehrsprache	englisch
ECTS	5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester
Studiengänge	M.Sc. Food Science and Engineering, 2. Semester, Wahl M.Sc. Food Biotechnology, 2. Semester, Wahl M.Sc. Food Systems, 2. Semester, Wahl M.Sc. Lebensmittelchemie, 2. Semester, Wahl M.Sc. Bioeconomy, 2. Semester, Wahl (Profil: Transforming Food Systems) Promotionsstudiengang Naturwissenschaften; 1./2. Semester, Wahl
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	94
Arbeitsaufwand (in Stunden)	150
Lern- und Qualifikationsziele	The students learn to understand the sophisticated processing of milk in relation to the physical, chemical and microbiological properties of the raw material and the final product properties. Thereby analytical tools to characterize composition and structure of milk products are studied in order to understand material-process-function relationships. It also teaches the concept of mass and energy balance, the estimation of microbiological risk of milk products and the hazard associated with the various processing steps

	Theoretical knowledge is deepened in composition, analytics, hygiene and aseptic of membrane filtration/ fractionation, evaporation, powder processing. Finally, trouble shooting on practical issue will be done in groups and an outlook will be given to running research projects addressed on future developments and innovations
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 10 (first-in)
Modulprüfung und Gewichtung	Oral exam (20 minutes) or written exam
Studienleistung und Gewichtung	protocol
Online Science and Engineering of milk processing (1505-451)	
Person(en) verantwortlich	Jörg Hinrichs
Lehrform	Vorlesung
SWS	2
Inhalt	The topics are: 1) Physcis, chemistry milk components 2) Chemical and physical analytics 3) Hygiene and Aseptic processing 4) Vacuum evaporation and milk concentrates 5) Membrane materials and processing 6) Drying basics 7) Milk drying 8) Trouble shooting methods 9) Research innovations and outlook
Literatur	Scientific literature, doctoral theses, publications from the department, textbooks in the departmental library. Kessler H.G.: Food & Bio-Process Engineering – Dairy Technology. Verlag A. Kessler, München 2011 Belitz H.D., Grosch W., Schieberle P. Food Chemistry. Springer Verlag

	Lecture handouts
Anmerkungen	-
Online Seminar in advanced milk processing (1505-452)	
Person(en) verantwortlich	Jörg Hinrichs
Lehrform	Seminar
SWS	2
Inhalt	Rework lecture and questions, evaluation, discussion and deepening knowledge of the lecture.
Literatur	Scientific literature, doctoral theses, publications from the department, textbooks in the departmental library. Lecture handout
Anmerkungen	-

Modul: Personal Nutrition and Chronic diseases (Madrid 1)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	for detailed information on this module, please check Personal Nutrition and Chronic Diseases / Nutrición Personalizada y Enfermedades Crónicas
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Plant Quality (3408-460)

Modulverantwortung	Uwe Ludewig
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	Crop Sciences - Plant Nutrition and Protection (Master) 3. Semester, elective Bioeconomy (Master) 3. Semester, elective Earth and Climate System Science (Master) 3. Semester, elective Bioeconomy (Master) 3. Semester, elective
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	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.
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	Written exam (70 %)
Studienleistung und Gewichtung	Presentation (25 %) with extended abstract (5 %)
Plant Quality (3408-461)	
Person(en) verantwortlich	Günter Neumann Uwe Ludewig Franz Wiesler
Lehrform	Vorlesung mit Seminar
SWS	4
Inhalt	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
Literatur	• Current literature • Marschner's Mineral Nutrition of Higher Plants (2011, Academic Press)
Anmerkungen	-

Modul: Portfolio-Modul (Food Systems) (1507-480)

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	In connection with an agrarian science elective module.
Teilnahmevoraussetzung	Prior completion of the module “Introduction to Food Systems” is recommended.
Lehrsprache	deutsch/englisch
ECTS	1
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	semesterbegleitend | 1 Semester
Studiengänge	M.Sc. Food Systems (Wahl, 1. Semester)
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	30
Lern- und Qualifikationsziele	• 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
empfohlene Vorkenntnisse	-
Anmerkungen	For this module between 1 and 7.5 ECTS credits can be achieved with one or more assignments.
Modulprüfung und Gewichtung	written report
Studienleistung und Gewichtung	written report
Portfolio-Modul (Food Systems) (1507-481)	

Person(en) verantwortlich	Jochen Weiss
Lehrform	Projekt/Projektarbeit
SWS	-
Inhalt	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)
Literatur	-
Anmerkungen	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

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

Modulverantwortung	Joachim Müller
Bezug zu anderen Modulen	The module mediates methodological fundamentals for a MSc-Thesis in Post-Harvest Technology.
Teilnahmevoraussetzung	Basic knowledge in natural sciences (bachelor degree).
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 2)
Studiengänge	Agricultural Sciences in the Tropics and Subtropics (Master) 2. Semester, elective Biobased Products and Bioenergy (Master) 2. Semester, elective Food Systems (Master) 2. Semester, elective Environmental Protection and Agricultural Food Production (Master) 2. Semester, semi-elective
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	70
Selbststudium (in Stunden)	155
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	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
empfohlene Vorkenntnisse	-
Anmerkungen	-

Modulprüfung und Gewichtung	written exam (100 %)
Studienleistung und Gewichtung	-
Post-Harvest Technology of Food and Bio-Based Products (4403-551)	
Person(en) verantwortlich	Jens-Norbert Wünsche Joachim Müller
Lehrform	Vorlesung mit Übung und Exkursion
SWS	5
Inhalt	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.
Literatur	• 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.
Anmerkungen	-

Modul: Precision Farming (4404-520)

Modulverantwortung	Stefan Böttinger
Bezug zu anderen Modulen	This module shows links to other agricultural disciplins and improves the career perspectives in agricultural engineering.
Teilnahmevoraussetzung	Basic knowledge in English, basic knowledge in process engineering in plant production or practical experience in this field is required.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester
Studiengänge	Bioeconomy (Master) 2. Semester, elective (profile: Sustainable biomass production systems) Agricultural Sciences - Major: Crop Production Systems (Master) 2. Semester, elective Food Systems (Master) 2. Semester, elective Agricultural Sciences - Agricultural Engineering (Master) 2. Semester, semi-elective
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	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.
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	written (computer aided; 100 %)
Studienleistung und Gewichtung	-
Precision Farming (4404-521)	
Person(en) verantwortlich	Stefan Böttinger
Lehrform	Vorlesung mit Übung
SWS	4
Inhalt	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
Literatur	Heege, H.J. (2013): Precision in Crop Farming - Site-specific Concepts and Sensing Methods. Springer Dordrecht Heidelberg New York London
Anmerkungen	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.

Modul: Project Work in Sensory Science (Aarhus 6)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

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

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	
ECTS	10
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	for detailed information on this module, please check FBMPUB-Public health nutrition and consumer food choice
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Soft Matter Science I - Food Rheology and Structure (1505-500)

Modulverantwortung	Jörg Hinrichs
Bezug zu anderen Modulen	Requirement for participation in the elective module “Innovative Dairy Technology”
Teilnahmevoraussetzung	Scientific background in mathematics, physics and chemistry.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 4)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 1. Semester, Pflicht Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 3. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 3. Semester, Wahl Food Systems (Master, PO vom 01.10.2016), 1. Wahl
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	96
Selbststudium (in Stunden)	129
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The students learn the basic principles of food structure and rheology. They gain an awareness of the various measurement technologies used to define the structure of complex food matrices. They design and conduct experiments, including standard methods, and perform data analysis. They work in small groups to characterise food systems and also learn about process modelling. They become familiar with presenting their work through written laboratory reports and oral presentations.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 45
Modulprüfung und Gewichtung	Exam (80 % of total), seminar (20% of total) and practical seminar (to pass)
Studienleistung und Gewichtung	attendance in practical course, laboratory reports, seminar presentation
Food Systems: Looking Beyond Rheology and Structure (1505-501)	
Person(en) verantwortlich	Mario Jekle Jörg Hinrichs
Lehrform	Vorlesung

SWS	2
Inhalt	Principles of structural, mechanical, and dynamic characteristics of food systems. Basic information and fundamental terms in rheology, measurement technology for different food matrices, mechanical strain, dynamic rheology. Measuring systems and principles, methods in structure analysis, analysis of measurement data and modelling.
Literatur	Scientific literature, doctoral theses, publications from the department, textbooks in the departmental library.
Anmerkungen	-
Literature Seminar: Structural Models for Food Systems (1505-502)	
Person(en) verantwortlich	Mario Jekle Jörg Hinrichs
Lehrform	Seminar
SWS	2
Inhalt	Evaluation of publications and research contributions. Analysing scientific literature, presenting and discussing one topic.
Literatur	Scientific literature / library – additional literature, research journals
Anmerkungen	Lecture, including principles, methods, conclusion.
Practical Course on Rheology and Structure (1505-503)	
Person(en) verantwortlich	Mario Jekle Jörg Hinrichs
Lehrform	Übung
SWS	2
Inhalt	Practical course on food rheology and structure.
Literatur	Scientific literature, collection of methods, scientific publications and research articles
Anmerkungen	Student groups of 3 to 6 people

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

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	Second part to Soft Matter I - Food Rheology and Structure
Teilnahmevoraussetzung	Admission to a Master's program. Basic knowledge in physical chemistry and mathematics.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 1)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Pflicht Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 2. Semester, Wahl Bioeconomy (Master, PO vom 01.10.2014) 2. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Bioeconomy (ab WS 16/17) (Master, PO vom 01.04.2017) 2. Semester, Wahl (Profil: Transforming Food Systems) Food Systems (Master, PO vom 01.10.2019) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Upon completion of this online 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. Furthermore, students are able to develop stronger communication skills and develop their skills of applying digital tools by completing assignments and designing clear and well-organized presentatations, 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.
empfohlene Vorkenntnisse	-
Anmerkungen	Sign-up for module: in ILIAS Maximum number of participants: 50 Some lectures of this course might be held online.
Modulprüfung und Gewichtung	Written exam (75%) Oral or online exam optional. Three-minute-talk (10%) Poster and its presentation (15%)
Studienleistung und Gewichtung	Laboratory work, Laboratory presentation, Peer review
Soft Matter Science II - Food Physics (1507-511)	
Person(en) verantwortlich	Jochen Weiss
Lehrform	Vorlesung mit Übung und Praktikum
SWS	4
Inhalt	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, virtual lab projects, and generating individual flash talks and poster

	presentations based on current papers in the area of food physics.
Literatur	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
Anmerkungen	The module is taught online. Online live sessions are designed to answer student questions about the teaching material, and present student assignments in a mini-conference.

Modul: Soil Fertility and Fertilization in Organic Farming (3409-440)

Modulverantwortung	Torsten Müller
Bezug zu anderen Modulen	Work in research, public administration, extension services and NGOs.
Teilnahmevoraussetzung	Basic knowledge in organic or conventional farming. Good knowledge in biology and chemistry.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	Agricultural Sciences - Major: Crop Production Systems (Master) 3. Semester, semi-elective Bioeconomy (Master) 3. Semester, elective Environmental Science - Soil, Water, and Biodiversity (Master) 3. Semester, semi-elective Organic Agriculture and Food Systems (Master) 3. Semester, elective
Prüfungsdauer (in Minuten)	30
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	After completing this module, students are able to apply profound knowledge in all fields of soil fertility management and fertilisation in organic farming in different climatic areas, as well as in specific organic farming systems e.g. in bio-dynamic or organic biological farming. They are also proficient in dealing with relevant national and international regulations. During preparation for exams and while preparing and following up on lectures, students learn to cooperate and work independently. They learn and practice both critical and analytical thinking and reading of scientific literature. Through the seminar presentation, students practice and improve their capability of exploring a scientific issue and of presenting a limited scientific subject.
empfohlene Vorkenntnisse	-
Anmerkungen	-

Modulprüfung und Gewichtung	Oral exam (75 %). A failing grade in the final examination results in failing the module.
Studienleistung und Gewichtung	Presentation with handout (25 %). The successful completion of the "Compulsory assignment" (passing grade) is a prerequisite for participating in the final examination.
Soil Fertility and Fertilization in Organic Farming (3409-441)	
Person(en) verantwortlich	Torsten Müller
Lehrform	Vorlesung mit Übung und Seminar
SWS	4
Inhalt	Specific aspects of soil fertility and its maintenance under organic land cultivation. Nutrient and humus management within organic crop rotations. Nutrient and humus balances on field and farm scale. Organic and mineral fertilisation of arable land and grassland, including bio-fertilisers, bio-effectors, green manure and post harvest plant residues. Atmospheric N2-fixation. Specific aspects of fertilisation in Bio-Dynamic and Organic-Biological Farming. Supervised reading of scientific literature. Seminar: Recent scientific issues on soil fertility and fertilisation in Organic Farming. Student's presentations.
Literatur	Literature will be announced during the lectures. Copies of presentations will be distributed during the lectures.
Anmerkungen	-

Modul: Understanding and Influencing Consumer Behaviour (Reading 4)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	
ECTS	7,5
Angebotshäufigkeit	
Dauer des Moduls	
Studiengänge	-
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	
Lern- und Qualifikationsziele	-
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-