UNIVERSITÄT HOHENHEIM

Modulhandbuch

für den Studiengang

Master of Science

Food Systems

Stand Oktober 2019

Studiengang: Food Systems (Master)

Modul: Advanced Flavor Chemistry (1508-410)

Modulverantwortung	Yanyan Zhang
Teilnahmevoraussetzungen	Scientific background in chemistry and biotechnology
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 1)
Verbindlichkeit	Wahl
Studienleistung	Participation in lecture, seminar (presentation & report), and practice course (protocol)
Modulprüfung	Written exam (80%), seminar (20%), practical course (passed)
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56h attendance + 140h independent studies = 196h workload
Fachkompetenzen / 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.
Schlüsselkompetenzen	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 presenta-tions.
Anmerkungen	https://ilias.uni-hohenheim.de/ilias.php?ref_id=652887&cmdClass=ilobjcoursegui&cmd=view&cmdNode=s0:hz&baseClass=ilrepositorygui

Advanced Flavor Chemistry (1508-411)

Person(en) verantwortlich	Yanyan Zhang
Person(en) begleitend	Dr. Martin Spraul
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.
Advanced Flavor Chemistry (1508-411)	
Person(en) verantwortlich	Yanyan Zhang
Person(en) begleitend	Dr. Martin Spraul
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.
Advanced Flavor Chemistry (1508-412)	
Lehrform	Seminar
SWS	1
Inhalt	Evaluation of publications and research contributions. Conclusion of scientific literature, presenting and discussing on topic on flavour chemistry and biotechnology.

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

Modulverantwortung	Prof. Dr. Jochen Weiss
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	7,5

Angebotshäufigkeit	jedes WS
Semesterlage	1. Semester
Dauer des Moduls	4 Wochen (Block 1)
Verbindlichkeit	Wahl
Studienleistung	Klausur, Referat/Vortrag
Prüfungsleistung	Klausur, Referat/Vortrag
Modulprüfung	Klausur 80%, Referat/Vortrag 20%
Prüfungsdauer	120 Minuten
Arbeitsaufwand	60 h Präsenzzeit + 165 h Eigenanteil = 225 h Arbeitsaufwand
Fachkompetenzen / 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 opera-tions 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.
Schlüsselkompetenzen	The aim of the course is that after completion of the course, students are able to have advanced knowledge in key unit operations. Participants apply critical problem assessments and discriminate tasks and targets with analytical thinking. They evaluate the results for evaluation of known quality criteria. They develop their creative potential, their ability to communicate and cooperate in teamwork. They represent scientific results in an appropriate manner and improve their verbal skills.
Anmerkungen	Anzahl Teilnehmerplätze: 24 Anmeldung zum Modul: Ilias 150 g Anmeldezeitraum: Registration opens 4 weeks prior to the start of the semester Kriterien, nach denen Studienplätze vergeben werden: in order of receipt
Advanced Meat Science and Technology (1507-501)	
Person(en) verantwortlich	Prof. Dr. Jochen Weiss
Person(en) begleitend	Kurt Herrmann, Dr. rer. nat. Monika Gibis
Lehrform	Vorlesung
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 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 cul-tures). 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.
Literatur	Script to the module
Anmerkungen	Registration opens 4 weeks prior to the start of the semester and closes at the begin-ning of the semester. First preference will be given to students enrolled in the M.Sc. Food Science and Engineering and then M.Sc. Food Biotechnology. Remaining free slots will then be given to students enrolled in other M.Sc. degree programs.
Advanced Meat Science and Technology (1507-502)	
Person(en) verantwortlich	Prof. Dr. Jochen Weiss
Person(en) begleitend	Kurt Herrmann, Dr. rer. nat. Monika Gibis
Lehrform	Übung
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 im-portant 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	Prof. Dr. Jochen Weiss
Person(en) begleitend	Kurt Herrmann, Dr. rer. nat. Monika Gibis
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	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.

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

Modulverantwortung	Prof. Dr. Bernd Hitzmann
Teilnahmevoraussetzungen	English language skills
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Studienleistung	Passing the practical course
Modulprüfung	a written exam
Prüfungsdauer	60 Minuten
Arbeitsaufwand	56 h attendance + 132 h independent study = 188 h workload
Fachkompetenzen / 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.
Advanced Process Engineering Techniques for Cereal Processing (1509-501)	

Person(en) verantwortlich	Prof. Dr. Bernd Hitzmann
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

Modul: AgFoodTech (1507-450)

Modulverantwortung	Prof. Dr. 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.
Teilnahmevoraussetzungen	Before starting this module, the “SPOC: Introduction to Food System” module has to be completed successfully
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	1. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Pflicht
Prüfungsleistung	Klausur
Modulprüfung	Klausur
Prüfungsdauer	90 Minuten

Arbeitsaufwand	56 h Präsenzzeit + 169 h Eigenanteil = 225 h Arbeitsaufwand
Fachkompetenzen / 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
Schlüsselkompetenzen	- Making value judgments and sustainability competencies - Creativity skills and competencies - Research skills and competencies - Intellectual transforming skills and competencies
AgFoodTech (1507-451)	
Person(en) verantwortlich	Prof. Dr. Jochen Weiss
Person(en) begleitend	Prof. Dr.-Ing. habil. Jörg Hinrichs, Prof. Dr. Joachim Müller, Dr. sc. agr. Friedrich Longin, Prof. Dr. Roland Gerhards, Prof. Dr.-Ing. Reinhard Kohlus, Prof. Dr. sc. agr. Hans W. Griepentrog, Prof. Dr. Bernd Hitzmann
Lehrform	Vorlesung mit Übung, Praktikum und Exkursion
SWS	4
Inhalt	AgriFood Science and Engineering combines knowledge and skill from the fields of agrarian technology and food processing.

Modul: Dairy Science and Technology (1505-440)

Modulverantwortung	Prof. Dr.-Ing. habil. Jörg Hinrichs
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Prüfungsleistung	Exam (70 % of total), practical seminar (30% of total)
Modulprüfung	Written (120 minutes) or oral (20 minutes) exam
Prüfungsdauer	120 Minuten
Arbeitsaufwand	70 h attendance + 108 h independent study = 188 h workload

Fachkompetenzen / Lern- und Qualifikationsziele	The aim of the course is to learn about the physical and chemical properties of milk ingredients and their processing characteristics. The relationships between raw material processing technology and product characteristics are introduced. It also teaches the concept of mass and energy balances, the estimation of the microbial risk of dairy products and the hazards associated with the various processing steps. The students develop their ability to work independently through practical work. At the same time, they are expected to work in teams for some exercises. They also gain problem solving skills in these tasks.
Anmerkungen	Maximum number of participants: 25
Dairy Science and Technology (1505-441)	
Person(en) verantwortlich	Prof. Dr.-Ing. habil. Jörg Hinrichs
Lehrform	Vorlesung mit Übung, Praktikum und Exkursion
SWS	5
Inhalt	- Physics and chemistry of milk components - Analytical tools - Hygiene and aseptic - Evaporation to milk concentrate - Membrane filtration to fractionate milk - Milk powder production tehnology & application aspects - Milk desserts and foams
Literatur	Kessler, H.G., Food & Bio Process Engineering – Dairy Technology, A. Kessler, München, 2011. Hinrichs, J., Lecture notes Palzer, S., Lecture notes
Anmerkungen	A one-day excursion is part of this module.

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

Modulverantwortung	Prof. Dr.-Ing. Reinhard Kohlus
Teilnahmevoraussetzungen	Knowledge of equivalent to Food Process Design I, e.g. Basics of fluid mechanics, mass and heat transfer, unit operations in food processing.
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 4)

Verbindlichkeit	Wahl
Modulprüfung	Written exam (60 minutes), oral exam (30 minutes).
Arbeitsaufwand	56 h attendance + 154 h independent study = 210 h workload
Fachkompetenzen / 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.
Schlüsselkompetenzen	Key competencies addressed in this module are critical problem assessment and analytical thinking.
Anmerkungen	Maximum number of participants: 20 Registration via ILIAS until 2 weeks before the course starts.
Drying, Granulation and Instantisation, Lecture (1503-541)	
Person(en) verantwortlich	Prof. Dr.-Ing. Reinhard Kohlus
Person(en) begleitend	Dr. Martin Spraul
Lehrform	Vorlesung
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	Prof. Dr. 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.
Teilnahmevoraussetzungen	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”.
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Pflicht
Prüfungsleistung	schriftlicher Bericht, Präsentation
Modulprüfung	60% Case Study + 40% Pitch
Prüfungsdauer	20 Minuten
Arbeitsaufwand	56 h Präsenzzeit + 169 h Eigenanteil = 225 h Arbeitsaufwand
Fachkompetenzen / Lern- und Qualifikationsziele	Upon completion of this module, students will be able to:\r\n• Describe the business environment in the food sector\r\n• Perform due diligence analysis on a specific food sector idea\r\n• Articulate the market opportunity including a competitor analysis and industry assessment\r\n• Develop a commercialisation strategy\r\n• Pitch the strategy to potential investors
Schlüsselkompetenzen	Upon completion of this module, students will:\r\n\r\n• be able to translate innovations into feasible business solutions for the food sector\r\n• be able to think beyond boundaries and systematically explore and generate new ideas, responding to current and future challenges within the food system\r\n• 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.\r\n• 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
Emerging Technologies Business Case Study (1507-461)	
Person(en) verantwortlich	Prof. Dr. Jochen Weiss
Lehrform	Kurs
SWS	4
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

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

Modulverantwortung	Prof. Dr. Jochen Weiss
Teilnahmevoraussetzungen	Admission to a Master's program or the doctoral degree program at the Faculty of Natural Sciences. This module requires basic knowledge of food structures.
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	1. Semester
Dauer des Moduls	4 Wochen (Block 3)
Verbindlichkeit	Wahl
Studienleistung	Präsentation: Laboratory work
Prüfungsleistung	Präsentation: Development project
Modulprüfung	Mündliche Prüfung (75% der Gesamtnote), Projekt und Präsentation über dieses Projekt (25% der Gesamtnote)
Prüfungsdauer	20 Minuten
Arbeitsaufwand	68 h attendance + 127 h independent study = 195 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Upon completion of the module, students are expected to have gained an overview of the importance of encapsulation, and encapsulants for applications in food and related fields. The students are able to demonstrate an understanding of (i) the physicochemi-cal properties of functional ingredients, (ii) the fundamental physical and chemical processes governing the behavior and stability of the encapsulation systems, and (iii) principles of encapsulation technologies and key processing parameters, and apply this knowledge to encapsulation-related

	challenges. Furthermore, the students are able to explain, evaluate, and communicate their findings/solutions to their peers and professionals.
Schlüsselkompetenzen	Upon completion of the module, students are able to work as a part of a team, and develop stronger communication skills by completing assignments and designing clear and well-organized presentations. The students are expected to apply critical and analytical thinking to solve encapsulation-related challenges. Furthermore, the students are encouraged to demonstrate their critical and analytical thinking skills by asking critical questions during the student presentations. Students are able to improve their written and oral English skills.
Anmerkungen	Available places: 16 Registration: latest 2 weeks before the begin of the module Registration period (Anmeldezeitraum): at the beginning of semester (zu Semesterbeginn) Criteria for asssigning available study places (Kriterien, nach denen Studienplätze vergeben werden): On first come, first-served basis.
Encapsulation of Functional Food Components (1507-411)	
Person(en) verantwortlich	Prof. Dr. Jochen Weiss
Person(en) begleitend	Dr. Benjamin Zeeb, Dr. rer. nat. Hanna Salminen, Dr. Thrandur Helgason
Lehrform	Seminar mit Übung
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 industries. Industry-hosted lectures give insights into encapsulation from an industrial point-of-view. Student assignments aim to promote knowledge transfer and enable the students to apply scientific concepts and scientific literature. These assignments involve, for example, a literature-based development project and a laboratory study. Both assignments will be also orally presented during the module
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: 16

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

Modulverantwortung	Prof. Dr.-Ing. Reinhard Kohlus

Teilnahmevoraussetzungen	Knowledge of equivalent to Food Process Design I, e.g. Basics of fluid mechanics, mass and heat transfer, unit operations in food processing.
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 3)
Verbindlichkeit	Wahl
Modulprüfung	Written or oral exam depending on the number of participants.
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h attendance + 154 h independent study = 210 h workload
Fachkompetenzen / 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.
Schlüsselkompetenzen	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.
Anmerkungen	Maximum number of participants: 24 Registration via ILIAS
Food Process Design II – Process Integration and Scale up, Lecture and Exercise (1503-501)	
Person(en) verantwortlich	Prof. Dr.-Ing. Reinhard Kohlus
Lehrform	Vorlesung mit Übung
SWS	4
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: Free Project Work (1500-020)

Modulverantwortung	Prof. Dr. rer. nat. Lutz Fischer
Teilnahmevoraussetzungen	M.Sc. Food Biotechnology
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Semesterlage	1. Semester
Dauer des Moduls	n. V.
Verbindlichkeit	Wahl
Prüfungsleistung	Report (50%) and Presentation (50%)
Modulprüfung	Report and Presentation
Prüfungsdauer	30 Minuten
Arbeitsaufwand	210 h
Fachkompetenzen / 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
Anmerkungen	Maximum number of participants: 3 Students have to find a professor to supervise the project.

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

Modulverantwortung	Prof. Dr. Roland Gerhards
Teilnahmevoraussetzungen	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.

Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	1 Semester, ein Teil geblockt
Verbindlichkeit	Wahl
Studienleistung	Two presentations with discussion (15% each)
Prüfungsleistung	Written exam (70%)
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h Präsenz + 104 h Eigenanteil + Prüfung = 160 h Workload
Fachkompetenzen / 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.
Schlüsselkompetenzen	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.
Anmerkungen	For the block course "Ihinger Hof", a special registration is needed.
Sensor Technologies for Plant Protection (3602-461)	
Person(en) verantwortlich	Prof. Dr. 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.
Application Technologies and Expert Systems in Weed Mangement with Exercises (3602-462)	

Person(en) verantwortlich	Prof. Dr. 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 8 a.m. to 5 p.m. Students will get accomodation and food at Ihinger Hof. A separate (personal) registration in the office of Phytomedicine is necessary.

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

Modulverantwortung	Prof. Dr. Jochen Weiss
Bezug zu anderen Modulen	-
Teilnahmevoraussetzungen	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.
Sprache	deutsch/englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Semesterlage	1. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Prüfungsleistung	schriftlicher Bericht
Modulprüfung	Praktikumsbericht
Arbeitsaufwand	225 h Arbeitsaufwand
Fachkompetenzen / 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
Schlüsselkompetenzen	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
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.

Modul: Irrigation and Drainage Technology (4403-410)

Modulverantwortung	Prof. Dr. Joachim Müller
Teilnahmevoraussetzungen	Basic knowledge in soil science, soil tillage and irrigation.
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 4)
Verbindlichkeit	Wahl
Modulprüfung	written
Prüfungsdauer	120 Minuten
Arbeitsaufwand	70 h Präsenz + 130 h Eigenanteil + Prüfung = 200 h Workload
Fachkompetenzen / 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.
Schlüsselkompetenzen	critical and analytical way of thinking, self-dependend working style, written and verbal skills, communication and cooperation capabilities
Anmerkungen	ab SS 2015 in neuer Form (vorher:Water and Soil Management in Agricultural Production)

Irrigation and Drainage Technology (4403-411)	
Person(en) verantwortlich	Prof. Dr. Joachim Müller
Person(en) begleitend	Dr. Wolfram Spreer
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
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: Master’s Thesis Food Systems (1507-430)

Modulverantwortung	Prof. Dr. Jochen Weiss
Bezug zu anderen Modulen	-
Teilnahmevoraussetzungen	mind. 60 ECTS erbrachte Leistung
Sprache	englisch
ECTS	30
Angebotshäufigkeit	jedes Semester
Semesterlage	4. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Pflicht

Modulprüfung	Die Master-Arbeit besteht aus dem schriftlichen Teil (die eigentliche Arbeit) und eine Präsentation im Rahmen der Graduiertenkonferenz. Die Präsentation macht 10% der Gesamtnote der Master-Arbeit aus.
Arbeitsaufwand	900 h Eigenanteil = 900 h Arbeitsaufwand
Fachkompetenzen / 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.
Schlüsselkompetenzen	- Creativity skills and competencies - Research skills and competencies - Intellectual transforming skills and competencies

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

Modulverantwortung	Prof. Dr. Joachim Müller
Bezug zu anderen Modulen	The module mediates methodological fundamentals for a MSc-Thesis in Post-Harvest Technology.
Teilnahmevoraussetzungen	Basic knowledge in natural sciences (bachelor degree).
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Modulprüfung	written
Prüfungsdauer	120 Minuten
Arbeitsaufwand	70 h Präsenz + 130 h Eigenanteil + Prüfung = 200 h Workload
Fachkompetenzen / 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
Schlüsselkompetenzen	kritisches und analytisches Denken, selbstständiges Arbeiten, schriftliche und mündliche Ausdrucksfähigkeit, Kommunikations- und Kooperationsfähigkeit
Post-Harvest Technology of Food and Bio-Based Products (4403-551)	

Person(en) verantwortlich	Prof. Dr. Joachim Müller, Prof. Dr. Jens Wünsche
Person(en) begleitend	Dr. sc. agr. Marcus Nagle, Dr. Dimitrios Argyropoulos, Dr. Shkelqim Karaj, Dr. Sajid Latif
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	EnglishMulton, 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.

Modul: Precision Farming (4404-520)

Modulverantwortung	Prof. Dr. sc. agr. Hans W. Griepentrog
Bezug zu anderen Modulen	This module shows links to other agricultural disciplins and improves the career perspectives in agricultural engineering.
Teilnahmevoraussetzungen	Basic knowledge in English, basic knowledge in process engineering in plant production or practical experience in this field is required.
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Modulprüfung	schriftlich (computerunterstützt)

Arbeitsaufwand	56 h Präsenz + 104 h Eigenanteil + Prüfung = 160 h Workload
Fachkompetenzen / 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.
Schlüsselkompetenzen	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.
Precision Farming (4404-521)	
Person(en) verantwortlich	Prof. Dr. sc. agr. Hans W. Griepentrog
Person(en) begleitend	Dr. sc. agr. Daniela Stoffel-Jauß
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: Scientific Writing and Reporting (1501-520)

Modulverantwortung	Prof. Dr. Herbert Schmidt
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS

Semesterlage	1. Semester
Dauer des Moduls	4 Wochen (Block 1)
Verbindlichkeit	Wahl
Modulprüfung	Preparing and giving a ca. 30 minute presentation with ensuing discussion on a given natural scientific topic in English (internally graded, grade does not count towards the final grade)
Arbeitsaufwand	112 h attendance + 113 h independent study = 225 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Students know how to - look for literature independently - use statistical methods for analysing experimental data and molecular-biological databases - maintain a laboratory journal - discuss the basic of scientific practice - analyse and discuss micro-biological and biotechnological publications - draft, write and discuss biotechnological presentations and publications - are able to articulate themselves well in the context of natural scientific topics, both in written and spoken form - give scientific presentations - actively participate in scientific discussions - use new experimental and analytical methods in the areas of biotech-nology and microbiology
Literature Research (1501-521)	
Person(en) verantwortlich	Prof. Dr. Herbert Schmidt
Lehrform	Übung
SWS	2
Inhalt	Introduction to literature research (internet, library, interlibrary loan) Introduction to the analysis of statistical experimental data Exemplary display of molecularbiological databases for finding new or improving known proteins
Anmerkungen	This course is compulsory for all students of this MSc, also for those who have successfully completed the module Einführung in wissen-schaftliches Arbeiten (Bachelor's programme Lebensmittwelwissenschaft und Biotechnologie) (1502-020).
Scientific Publications (1501-522)	
Person(en) verantwortlich	Prof. Dr. Herbert Schmidt
Lehrform	Seminar mit Übung
SWS	4

Inhalt	Introduction, theory and practice of scientific publications and presentations Students are given a topic / review & publication Preparation and independent presentation of a ca. 30-minute scientific presentation on a publication in the area of food microbiology and biotechnology with ensuing discussion
Introduction in Microbiological and Enzymatic Methods (1501-523)	
Person(en) verantwortlich	Prof. Dr. Herbert Schmidt
Person(en) begleitend	Dr. Agnes Weiß, Dr. rer. nat. Elisabeth Hauser
Lehrform	Praktikum
SWS	2
Inhalt	The students learn: - Sterile working techniques - Factorial growth kinetics - Determination of food ingredients (e.g. ethanol, glucose, fructose, sucrose, nitrate, citrate) by enzymatic methods - Determination of enzyme activities in food - To protocol experiments - Using statistical methods for analysing experimental data
Literatur	Henniger, G. (2003) Enzymatic techniques for authenticating food components in Lees, M. (ed.) Food Authenticity and Traceability, CRC Press, 239-274

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

Modulverantwortung	Prof. Dr. Jochen Weiss
Bezug zu anderen Modulen	Second part to Soft Matter I - Food Rheology and Structure
Teilnahmevoraussetzungen	Admission to a Master’s program. Basic knowledge in physical chemistry and mathematics.
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 1)
Verbindlichkeit	Wahl
Studienleistung	Laboratory presentation, Laboratory work
Prüfungsleistung	Klausur, Referat/Vortrag: 3-min. Talk, Poster presentation, Poster

Modulprüfung	Klausur (75%), optional mündliche Prüfung, Vortrag (10%), Poster mit Präsentation (15%)
Prüfungsdauer	90 Minuten
Arbeitsaufwand	64 h Präsenzzeit + 146 h Eigenanteil = 210 h Arbeitsaufwand
Fachkompetenzen / Lern- und Qualifikationsziele	Upon completion of the module, students are expected to have gained knowledge of physical phenomena that play a role in food systems. The students are able to demonstrate an understanding of (i) molecular material science approach to food systems, and (ii) structure-function relationships in matrices composed of proteins, lipids, and carbohydrates, and (iii) the operating principles of advanced physical analytical techniques as well as their use in the analysis of complex food structures. The students are able to apply principles of molecular mass transport, solution thermodynamics, phase transi-tions, and molecular interactions to solve problem-oriented case studies in foods. Furthermore, the students are able to explain, evaluate, and communicate concepts and results to their peers and professionals.
Schlüsselkompetenzen	Upon completion of the module, students are able to work as a part of a team, and develop stronger communication skills by completing assignments and designing clear and well-organized presentations, posters and flash talks. The students are expected to apply critical and analytical thinking to solve food physics-related challenges. Students are able to improve their written and oral English skills.
Anmerkungen	Maximum number of participants: 50
Soft Matter Science II - Food Physics (1507-511)	
Person(en) verantwortlich	Prof. Dr. 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, and laboratory studies that will be also orally presented during the module. Moreover, individual flash talks and poster presentations based on current papers in the area of food physics will be presented in a formal scientific setting of a mini-conference during the module.
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

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

Modulverantwortung	Prof. Dr. 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.
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Semesterlage	1. Semester
Dauer des Moduls	4 Wochen (Block 1)
Verbindlichkeit	Pflicht
Prüfungsleistung	50 % Essay (5-10 Seite) + 50% Klausur
Modulprüfung	50 % Essay + 50% Klausur
Prüfungsdauer	90 Minuten
Arbeitsaufwand	225 h Arbeitsaufwand
Fachkompetenzen / 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
Schlüsselkompetenzen	They can also - outline their own competence profile in different subfields of the food sector - formulate individual development goals
Introduction to Food Systems (1507-441)	

Person(en) verantwortlich	Prof. Dr. 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.

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

Modulverantwortung	Prof. Dr. 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.
Teilnahmevoraussetzungen	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
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 1)
Verbindlichkeit	Pflicht
Prüfungsleistung	Präsentation
Modulprüfung	Vortrag/Präsentation
Prüfungsdauer	30 Minuten
Arbeitsaufwand	56 h Präsenzzeit + 169 h Eigenanteil = 225 h Arbeitsaufwand
Fachkompetenzen / Lern- und Qualifikationsziele	Upon completion of the course, students will \r\n- understand concepts of innovation and entrepreneurship in the context of the food system, such as writing a business plan, financing and intellectual properties\r\n- be familiar with strategies for idea generation, design thinking and project management\r\n- be able to find innovative solutions to food systems problems
Schlüsselkompetenzen	Upon completion of the course, students will be able to\r\n- translate research into real-world impacts

Summer School: Introduction to Entrepreneurship (1507-471)	
Person(en) verantwortlich	Prof. Dr. Jochen Weiss
Lehrform	E-Learning
SWS	4
Inhalt	Unterrichten und Üben in Bezug auf - Konstruktionsdenken - Ideengenerierung - Finanzierung - geistiges Eigentum - Projektmanagement - Business-Modelle -Entwicklung eines Business-Plans
Anmerkungen	Die Summer School wird mit den innovativen Lehrmethoden durchgeführt, die auf dem umgedrehten Unterrichtskonzept basieren.