

Degree Program Documentation

Bachelor's Program

Food Technology

Part A
TUM School of Life Sciences
Technical University of Munich

General Information:

- Administrative responsibility: TUM School of Life Sciences
- Name of degree program: Food Technology
- Degree: Bachelor of Science (B.Sc.)
- Standard duration of study and credits: 6 semester of enrollment and 180 credit points (CP)
- Form of study: full time
- Admission: unrestricted admission
- Start: Winter semester (WiSe) 2008/2009
- Language: German
- Main Location: Freising
- Academic administrator (program design):
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1 Degree Program Objectives

1.1 Purpose

Nowadays, a large proportion of food is not consumed fresh, but in processed form. The demands placed on such foods are constantly increasing. The markets not only demand high-quality and safe products, but also regular innovations. One current trend, for example, is the increasing demand for vegetarian or vegan products. Products made from plant-based protein sources often undergo a variety of complex production steps. But even with established foods, such as confectionery like chocolate, baked goods or preserved products like milk or fruit juices, through to ready meals like pizza, new production processes enable constant improvements in flavor, nutritional content and sustainability aspects.

Manufacturers are aiming for ever more energy-efficient production processes as a contribution to conserving resources. Industrial food production therefore plays an important role for society as a whole in the overall food supply chain. Food technology recognizes this importance for society as a whole by focusing on the special features of food production compared to other manufacturing industries. These special features result from the biogenic origin and the associated variability of the raw materials, the special requirements for safety and sustainability and the food-specific processing methods. These diverse demands on products and manufacturing processes require highly trained specialists with comprehensive expertise in traditional and innovative production systems and plant technologies as well as a profound overview of the entire food value chain, from raw materials to packaging.

The aim of the Food Technology degree program is to train interdisciplinary engineers for industrial food production. Graduates are tasked with the safe operation of food production facilities and the development of new food products and processes. They can pick up on new developments and turn them into innovations. Responsible use of resources in terms of sustainable food production is also part of the profile.

1.2 Strategic Significance

For years, the TUM School of Life Sciences (LS) has been training process engineers who can design and conceptualize production processes in the food industry. The use of fermentative/biotechnological processes is a connecting element to other related Bachelor's degree programs at LS (Brewing and Beverage Technology, Pharmaceutical Bioprocess Engineering). However, the focus of those related Bachelor's degree programs is on the beverage and pharmaceutical industry.

The Bachelor's degree program in Food Technology is followed by a consecutive Master's degree program in Food Technology at the Technical University of Munich (TUM), which is also based at the LS. The Bachelor's program lays the foundations for acquiring in-depth process engineering and methodological skills. Students also have the opportunity to specialize in specific areas of food technology and gain their first guided experience of scientific work as part of their Bachelor's thesis. With responsibility, talent and scientific and technological excellence, TUM strives to play a leading role in the sustainable transformation of society and innovative value creation in order to enable prosperity in harmony with nature and the environment.

The consecutive degree program in Food Technology uses the School's structures and competencies in the fields of engineering and biotechnology and complements them with a focus on food technology. The thematic networking of the individual related degree programs mentioned above also enables students to gain an insight into different sectors of the biotechnology industry and thus acquire interdisciplinary skills.

With the **TUM Sustainable Futures Strategy 2030**, TUM aims to become a shaper of sustainable development - scientifically, economically, ecologically and socially. The Food Technology degree program is committed to TUM's mission statement and makes a significant contribution to the implementation of its sustainability strategy in teaching. The program focuses on aspects of social transformation for sustainable and climate-resilient development. To this end, it deals with issues such as the production of high-quality, safe and healthy food and thus contributes to a sustainable food supply. The production of products in an industrial environment is based on the sustainable, climate-friendly utilization of resources, including closed raw material cycles. Through a basic economic education and the possibility of using a TUM Food & Agro Centre for Innovation and Technology (FACIT) tailored to the needs of the relevant areas of application, we lay the foundation for independent, sustainable entrepreneurial action by graduates.

The integration of the study program bundle into the wider LS environment offers a particular advantage for the training of food technologists. The Weihenstephan campus has interdisciplinary knowledge of life sciences, especially microbiology, biochemistry and molecular biotechnology. Due to this bundling of competences that are necessary for food technology, qualified graduates can be trained here. Synergies also result from the existing knowledge in the beverage sector and the good cooperation with the School of Engineering and Design and the Nutritional Sciences degree program for individual courses.

2 Qualification Profile

Students on the Bachelor's degree program in Food Technology receive a broad basic education in the natural sciences and mathematics. Microbiological aspects also play a central role here. In various parts parallel to this or building on it, they acquire a broad technical profile in the field of engineering (together with the related Bachelor's degree programs of the LS) and finally - especially for them - skills in the field of food technology. After completing the Bachelor's degree program, students are able to combine the specialist knowledge they have acquired from all areas and apply it in a problem-solving manner. The competences that graduates can demonstrate after successfully completing a Bachelor's degree are listed below.

The content of the following qualification profile corresponds to the requirements of the Qualifications Framework for German Higher Education Qualifications (Hochschulqualifikationsrahmen - HQR) and the requirements contained therein (i) knowledge and understanding, (ii) use, application and generation of knowledge, (iii) communication and cooperation and (iv) scientific self-conception/professionalism. The formal aspects according to the HQF (admission requirements, duration, degree options) are detailed in chapters 3 and 6 as well as in the corresponding subject examination and study regulations.

Knowledge and Understanding

- Graduates know and understand the mathematical/scientific concepts required to solve food technology problems (e.g. statistical methods of data evaluation, microbiological principles).
- Graduates know and understand the engineering fundamentals in the fields of mechanics, fluid mechanics and thermodynamics (e.g. strength calculations, pipe flows and energy balancing).
- Graduates know and understand the technologies used in industrial food production (e.g. methods of preservation such as drying).
- Graduates have a broad knowledge of a wide range of products and processes in the food industry (starch-based, protein and fat-containing food products).
- Graduates know and understand the legal and hygienic framework conditions for the production of food.

Use, Application and Generation of Knowledge

- Graduates are able to apply the mathematical, scientific and engineering fundamentals they have learnt to a wide range of industrial problems.
- Graduates are able to use common technologies to produce a wide variety of foods in accordance with the legal framework and hygiene requirements.
- Graduates are able to assess the starting products and end products of food technology processes from a microbiological and chemical-technical perspective.
- Graduates are able to work safely in the laboratory in accordance with analysis regulations.
- Graduates are able to analyze, monitor and design individual food technology processes in order to generate and/or ensure the desired properties of food.
- Graduates are able to carry out experimental work in accordance with the state of the art under supervision and to reflect on, structure and document the results obtained.
- Graduates can analyze the economic efficiency of various process alternatives and plan production capacities.

Communication and Cooperation

- Graduates are familiar with the typical working methods of the specialized field and the relevant technical vocabulary.
- Graduates are proficient in interdisciplinary communication and are able to work constructively and solution-orientated in a team.
- Graduates are able to prepare, present and communicate research results in a way that is appropriate for the target group.

Scientific Self-Conception and Professionalism

- Graduates are qualified to work in the food industry as well as to continue their scientific education in the form of a subsequent Master's program.
- Graduates are able to select and apply suitable statistical methods for analyzing and critically evaluating complex data and processes.
- Graduates are able to work on problems from industrial practice using basic scientific methods.
- Graduates are able to critically reflect on their actions in their professional environment, especially in relation to society's increasing expectations regarding health and sustainability.

3 Target Groups

3.1 Target Audience

The Bachelor's degree program in Food Technology is aimed at first-year students with a keen interest in scientific and engineering issues and who enjoy solving interdisciplinary problems. A keen interest in biology, chemistry, math and physics as well as the ability to think in an interdisciplinary way are therefore advantageous. They should also have a keen interest in manufacturing processes, creative development and the product quality of food.

Future food technologists should be willing to work in an interdisciplinary team in order to be able to work innovatively in a constantly changing industry and contribute responsibly to solving problems for society as a whole.

3.2 Prerequisites

3.2.1 Basic Requirements

For the Bachelor's degree program in Food Technology, the general admission requirements for studying at a university must be fulfilled in accordance with the Ordinance on Qualifications for Studying at Universities of the Free State of Bavaria and State-recognized non-state universities (Qualification Ordinance-QualV) (BayRS 2210-1-1-3-K/WK) in the currently valid version. Otherwise, admission to the degree program is not restricted. Applicants should fulfil the following requirements:

- Ability to work in a scientific or basic research and method-orientated manner
- Recognizable interest and corresponding background knowledge for questions in the field of food technology, related fields (e.g. brewing and beverage technology or biotechnology) as well as other fields (e.g. engineering, natural sciences, etc.)
- Ability to solve complex problems
- Interest in solving application problems

3.2.2 Language Skills

As the lectures are held almost exclusively in German, prospective students who have sufficient knowledge of German are addressed. Foreign students must submit a language certificate recognized by TUM (C2 (Goethe), DSH-2, B2 (DSD II), 4 (TestDaF), telc Deutsch C1 Hochschule) together with all other documents by the application deadline.

Applicants are expected to have the ability to think in an abstract, logical and system-orientated way. A good command of English is also very helpful, as specialized literature is often only available in English. Students with deficits in this area can improve their English language skills as part of the elective program.

3.3 Target Numbers

For the Bachelor's degree program in Food Technology, the aim is to enroll 70-90 students. A basic and orientation examination in the first year of study helps students to determine their own suitability for the chosen degree program after a short time.

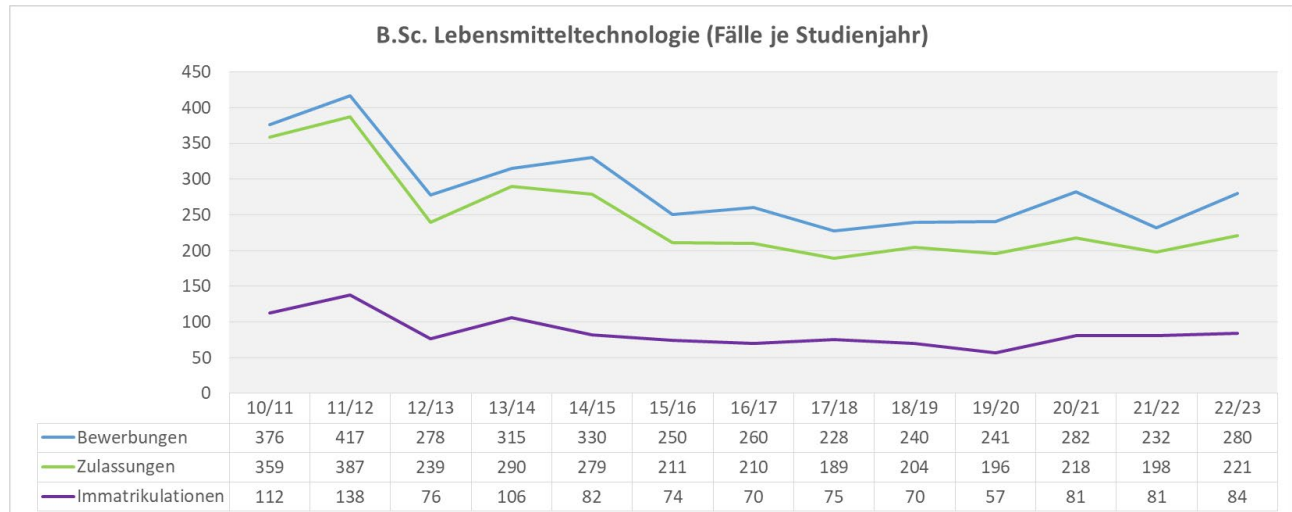


Figure 1: Applications, admissions and enrollments in the B.Sc. Food Technology plus B.Sc. Technology and Biotechnology of Food (Source: TUM indicator system)

Figure 1 shows the number of first-year students in the Bachelor's degree programs in Food Technology and its direct predecessor, Food Technology and Biotechnology, in recent years. In recent years, the number of first-year students has ranged between approx. 60 and 140, which largely corresponds to the target corridor. At the beginning of the reporting period, the double Abitur year was reflected in particularly high numbers of applicants. The "Weihenstephan" and "Technical University of Munich" brands contribute to the high demand for the degree program.

Table 1: Key figures B.Sc. Food Technology and B.Sc. Technology and Biotechnology of Food (Source: TUM Key Figure System)

	Winter term 2019/20	Winter term 2020/21	Winter term 2021/22	Winter term 2022/23
Applications (cases)				
Food Technology	237	282	232	280
Food Technology and Biotechnology	4	0	0	0
Admissions (cases)				
Food Technology	195	218	198	221
Food Technology and Biotechnology	1	0	0	0

Admission rate (cases) in %

Food Technology	82,3	77,3	85,3	78,9
Food Technology and Biotechnology				

Rejections (cases)

Food Technology	12	22	23	59
Food Technology and Biotechnology				

Enrollments from applications (cases)

Food Technology	56	81	81	84
Food Technology and Biotechnology	1			

Proportion of enrollments to admissions (cases) in %

Food Technology	28,7	37,2	40,9	38,0
Food Technology and Biotechnology				

Students (cases)

Food Technology	56	118	152	196
Food Technology and Biotechnology	90	71	41	23

Total	146	189	193	219
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Table 2: Students in the Bachelor's degree programs Food Technology plus Food Technology and Biotechnology by gender and origin for the winter semester 2022/2023 (source: TUM indicator system)

Total students	thereof male	Female	German	Foreigners	Education nationals	Educational foreigners
219	93	126	162	57	7	50

Table 2 shows the origin and gender of students in the winter semester 2022/2023. The Bachelor's degree program in Food Technology is more in demand from female students. However, the proportion of female students is still around 40%. The historically higher proportion of (male) students in the STEM subjects appears to have obviously and fortunately been overcome. The degree program also has a pleasing internationalization rate of over 20% foreign students.

4 Demand Analysis

The food manufacturing and processing industry covers a wide range of different sectors and is the fourth largest industrial sector in Germany with an annual turnover of 185 billion euros and an export

share of 33%. The industry supplies the German market alone with 170,000 different items every day¹.

There are currently around 610,000 employees (15% with an academic qualification) working in more than 6,100 companies (most of which are small and medium-sized with fewer than 250 employees) in various areas of the food industry². Around 35% of employees work in companies in the bakery industry, 23% in the meat and meat processing industry, followed by 8% in milk processing. The other 34% of employment opportunities are in the production of beverages, confectionery, fruit and vegetable processing, the production of ready meals, animal feed, food substitutes and additives, tea, coffee, animal and vegetable proteins and dietary foods.³

Graduates of food technology can be deployed in a wide variety of ways in food-producing companies of all kinds thanks to their wide-ranging training. The core tasks lie in the planning, monitoring, control and evaluation of production processes and the assurance of product quality.

Engineering skills are also required for the partial design of systems and components for manufacturing processes. There are also a wide range of employment opportunities here, as many of the world's leading plant engineering companies are based in Germany. Over 300 German manufacturers of bakery machines, meat processing machines, beverage production machines, dairy technology, confectionery machines, machines and systems for processing plant-based raw materials, packaging machines and machines and systems for manufacturing pharmaceutical and cosmetic products generate around 80% of the turnover of the entire German machinery and plant engineering industry⁴.

With a Bachelor's degree that qualifies them for a career, graduates mainly find employment in the field of production. However, the majority of graduates decide to continue their education with the consecutive Master's degree program on offer.

As the food industry has a high demand for constantly new, innovative and price-sensitive products, graduates are also used in a variety of ways in product development. In addition, there is a growing need for well-rounded graduates who are interested in working in research and development to help develop solutions that better capitalize on future market trends and growth opportunities. Industry associations see a growing need for innovative technologies and products in the categories of convenience, functional foods, protein substitutes and personalized dietary solutions. In addition, trends in packaging materials, technologies, digitalization and sustainability are driving the need for well-rounded graduates.

There are other fields of activity in industrial laboratories, industrial associations, public research institutions and state and federal government departments.

Graduates can also be employed in upstream and downstream areas such as the entire logistics chain, supply chain management, the raw materials, food supplements, enzymes and additives industries.

¹ Source: Federal Association of the German Food Industry, 2021

² Source: Federal Association of the German Food Industry, 2021

³ Source: Federal Statistical Office, 2021

⁴ Source: German Engineering Federation, 2021

5 Competition Analysis

5.1 External Competition Analysis

There are currently two undergraduate degree programs with a similar or related focus at German universities:

- B.Sc. Food Science and Biotechnology - University of Hohenheim
- B.Sc. Food Technology - TU Berlin

While the Bachelor's degree program in Food Technology at TUM focuses on engineering, the Bachelor's degree program in Food Science and Biotechnology at the University of Hohenheim focuses more on teaching molecular fundamentals. The biggest competitor in a national comparison is the TU Berlin with its undergraduate degree course in Food Technology, as it has clearly identified engineering as a specialization and made it compulsory in the curriculum. Due to the geographical distance, however, there is no direct competition, but rather coexistence. At other universities, food process engineering specializations only exist as individual working groups with corresponding specializations in a more general process engineering degree course.

Universities of Applied Sciences also currently offer Bachelor's degree programs in the field of food technology. The Weihenstephan-Triesdorf University of Applied Sciences offers a Bachelor's degree program in Food Technology, which is certainly a competitive offer due to its immediate geographical proximity. However, the curriculum is primarily aimed at a typical university of applied sciences education, neglects the classic university career path and prepares students less specifically for the consecutive Master's program.

Internationally, there are numerous degree programs dedicated to food. However, these are usually referred to as Food Science (and Technology) in the title (e.g. Cornell University, UC Davis) and place less emphasis on the technological engineering training that characterizes the degree program at TUM. Probably the most prominent provider of a comparable program in Europe is Wageningen University in the Netherlands. There is practically no direct competition due to the different national and regional target groups.

5.2 Internal Competition Analysis

In addition to the Bachelor's degree program in Food Technology, the Technical University of Munich also offers related Bachelor's degree programs in Brewing and Beverage Technology and Pharmaceutical Bioprocess Engineering. All three form a joint Professional Profile Life Science Engineering program. Large parts of the natural science and engineering fundamentals are covered in the Food Technology degree program together with the Brewing and Beverage Technology and Pharmaceutical Bioprocess Engineering degree programs, particularly in the early phases of the degree program. Despite the relationship and the structural and content-related similarities in the first semesters, a specialization in the chosen subject area emerges in the course of the degree program. The food technology content taught on the Bachelor's degree program in Food Technology is compulsory and can only be found on this degree program, thus enabling a clear specialization. The degree

programs are therefore not in competition with each other, but also offer students the opportunity to change their focus by switching between the degree programs relatively easily. Students who are committed to this are also always looking for the possibility of a double degree.

At the Technical University of Munich, only the Food Technology degree program teaches equal parts natural sciences and engineering paired with a specialization in food technology. The gradual development of food technology skills from the first semester of the degree program enables students to obtain a sufficient professional qualification with their Bachelor's degree.

6 Program Structure

The interdisciplinary, German-language Bachelor's degree program in Food Technology is a full-time course with a total of 180 ECTS credits. The standard period of study is six semesters. The Bachelor's program consists of a foundation and orientation examination in the first year of study, followed by the Bachelor's examination in the second and third years. The compulsory modules guarantee a consistently good basic education. The focus in the first year of study is on the natural sciences, which are essential for a successful Bachelor's degree. In the following years of study, the basis for the food technology and engineering training is laid. The Bachelor's degree qualifies graduates for activities in production, quality assurance and commissioning and lays the foundation for the scientifically oriented Master's degree program. The following diagram shows an exemplary course of study.

Figure 2: Exemplary curriculum of the Bachelor's degree program in Food Technology for the subject examination and study regulations 20221

Semester	Modules								Exams	Credits/ Exams
1.	LS30046 Introduction to Food Technology (GOP) K 5 CP	MA9615 Calculus (GOP) (5 P)	PH9035 Physics for Life Science Engineers 1 (GOP) K + LL (SL) 7 CP	LS30037 Cell Biology K 5 CP	WZ5322 General and Inorganic Experimental Chemistry with Lab (GOP) K (4 CP)	LS30041 Seminar on Good Scientific Practice LP 4 CP				6 30
2.	LS30038 Economics for Life Science Engineering K 5 CP		PH9036 Physics for Life Science Engineers 2 K 5 CP	WZ5426 Organic and Biological Chemistry (3 CP)		WZ5442 Applied Mechanics (2 CP)	WZ5047 Energetic Use of Biomass K 5 CP	WZ5005 Materials Engineering K 5 CP		6 30
3.	LS30043 Food Technology 1 K 5 CP	WZ5299 Statistics K 5 CP	LS30000 Introduction to Microbiology (2 CP)		WZ5437 Food Chemistry (1 CP)			WZ5196 Intellectual Property Law K 5 CP		6 30
4.	LS30031 Food Technology 2 LL 5 CP					WZ5013 Fluid Mechanics K 5 CP	LS30048 B.Sc. Lemi BrauBPT – Industrial Internship B (SL) 8 CP	WZ5183 Food Legislation K 6 CP		7 31
5.	LS30024 Food Analytics K + LL (SL) 5 CP	LS30039 Packaging Technology K 5 CP	LS30074 Food Microbiology K 5 CP			LS30036 Thermo-dynamics K 5 CP	LS30027 Energy-monitoring K 5 CP	WZ5046 Introduction to Electronics K 5 CP		7 30
6.	LS30044 Bachelor's Thesis W 12 CP	CLA30258 Jazzproject ÜL 3 CP	CLA21023 Passing Exams in Relaxed Mode B 2 CP			LS30035 Hygienic Processing K 6 CP		WZ5435 Machine and Plant Engineering K 6 CP		5 29
Key	Dark Blue = Mandatory Bachelor's Thesis Light Blue = Elective Modules Grey = Mandatory Modules Green = Basic and Orientation Exams (GOP) Orange = General Education Subject				PR = practical course; CP = Credit Points; SL = coursework; K = written exam ; M = oral Exam; LL = lab work; ÜL = exercise work; W = scientific research paper LP = learning portfolio; B = report					

6.1 Scientific Basics

In order to be able to understand the engineering and advanced food technology modules in the further course of study, a subject-specific introduction and mathematical/scientific basics (modules marked in green in Figure 2) are taught in the first two semesters of the degree program. The success of this basic training is assessed in the first year of study as part of the basic and orientation examination (GOP). The basic and orientation examination is used for this degree program instead of an admission restriction. All examinations within this GOP must be taken at the scheduled time and may only be repeated once. Students should use the GOP to show whether they are suitable for the Food Technology degree program.

The **Physics 1+2** and **Advanced Mathematics/Statistics** modules lay the foundations for the engineering modules that follow later. The focus in physics is on basic mechanics, electrical engineering, thermodynamics and optics and is therefore the starting point for mechanical and thermodynamic considerations. Advanced mathematics provides the mathematical tools for engineering and thermodynamics.

In the **Inorganic Chemistry** module, students are taught the chemical fundamentals of reaction kinetics and atomic models, which are essential for **organic and biological chemistry** and **food chemistry**. The **Organic and Biological Chemistry** module covers the correct nomenclature as well as formation and reaction pathways. The hydrocarbon compounds dealt with there are involved in all cell biological and physiological processes in biology. Furthermore, students learn the detailed structure of such molecules involved in metabolism and the metabolic mechanisms.

The scientific foundations are rounded off by the **Cell Biology** module. Students are shown the cellular structure of single and multi-cell organisms and their function. This knowledge is then taken up again in general **microbiology** and **food microbiology**. Here, the classification of microorganisms and their biotechnological usability and pathogenicity are discussed at a glance. Knowledge of the properties of microorganisms is very important for the subsequent biotechnological production of food. In addition to the production-positive and therefore useful microorganisms, microorganisms that are harmful to food are also dealt with, which must be prevented during production with suitable hygiene measures.

6.2 Engineering Sciences

The engineering sciences are one of the focal points of the Bachelor's degree program in Food Technology. The starting point for all engineering and process technology considerations is **technical mechanics**. This module is at the beginning of the Bachelor's examination. Here, the mechanical approaches from physics are taken up and deepened by means of static and kinetic problems. It thus forms the basis for further engineering modules such as **fluid mechanics** or in-depth electives.

When designing systems for the food industry, one of the main professional fields of graduates, the consideration of fluid dynamic systems is indispensable. The calculation and design of such systems are learnt in the **fluid mechanics** module. **Thermodynamics** provides a basis for understanding the design of auxiliary material flows (steam, energy), in which students learn, for example, how to calculate thermodynamic cycle and ideal gas processes.

Hygienic working is essential to ensure product quality and shelf life. Undesirable microorganisms can only be kept away from the product if the work is carried out cleanly. In the food industry, these potential germs must not be allowed to accumulate in the system, as they could be transferred to the product during the manufacturing process. On the one hand, it is therefore important to design the systems in such a way that there are as few dead spaces as possible for germs to accumulate. On the other hand, training in the correct cleaning and sterilization of the system is necessary. This topic is covered in the **Hygienic Processing** module.

Students can achieve a further engineering profile by choosing engineering elective modules from the so-called profile area.

6.3 Food Technology

In addition to the basic scientific training, subject-specific teaching is anchored right from the start. As early as the first semester, students are given an initial overview of the key processes of food processing and storage as well as the process and biotechnical fundamentals of food technology in the **Introduction to Food Technology** sub-module. The module thus creates a sense of identity for the students and allows them to reflect on their own study choices.

Building on this, the Food **Technology I+II** modules are designed to provide students with a deeper theoretical and practical understanding of the subject matter. The Food **Technology I** module primarily imparts technological knowledge about the properties, processing and storage of food in general. In addition, the various product groups and product structures (such as foams, gels, emulsions) are introduced.

The **Food Technology II** module provides a deeper insight into product production and processing. The basics of food process engineering are taught here. This knowledge is of particular importance for the design of processes to achieve a defined product quality and the manufacture of safe and high-quality products. The lecture is supplemented by a practical component.

In the **Food Analysis** module, students learn the theory and practice of wet chemical analysis, which is fundamental to the food industry. In addition to the intermediate products during food production, the raw materials are also analyzed with regard to quality and suitability. This lays the foundations for working in the field of quality assurance.

Food packaging is also becoming increasingly important for reasons of sustainability. The **packaging technology** module therefore lays the foundations for describing mass transfer processes in packaging. In addition, the basic requirements for packaging with regard to food safety and shelf life on the one hand and processability on the other are taught. Last but not least, the module shows how modern packaging concepts fulfil these requirements.

6.4 Overarching Content

The general principles of academic work are taught in the **Seminar on Good Scientific Practice** module. Both techniques for acquiring information (literature research, literature management) and project management tools such as time management are practiced. Students are encouraged to learn and plan independently right from the start of their studies. Later on, necessary skills such as word processing systems, mathematical software packages and presentation techniques are used, and academic texts are analyzed, written and mutually assessed. In this way, students acquire the skills they need to prepare experimental reports, discuss researched information and present their own scientific work.

For the professional practice of many graduates, knowledge of business contexts is of essential importance in today's corporate world and is therefore of the highest practical relevance. The **Economics** module teaches students basic economic and business contexts so that they understand companies as the subject of business administration. In addition, the use of internal and external accounting is explained, with the help of which they can master current challenges for companies in an economic context.

The **general education** module offers a wide range of further education, interdisciplinary, personality-building and horizon-broadening courses, from which students can choose the content that is most compatible with their personal and professional goals, based on their individual interests. To this end, students can choose from various areas, such as courses offered by the Carl von Linde Academy or the Language Centre.

6.5 Elective Modules

Students can use the electives to sharpen their own degree profile. A total of 45 credits can be earned within the framework of specialized electives. Of these 45 credits, 35 must be selected from **profile electives**, which are specified in a catalogue. Up to 10 credits from **industrial internships** can also be included here. As part of the **free elective modules** totaling a maximum of 10 credits, modules can be taken flexibly, provided they serve to develop the student's profile. A further 5 credits must be taken as part of the **General Studies** module.

6.6 Bachelor's Thesis

In the third year of study in particular, the previously acquired skills in the subject areas of natural sciences, engineering and food technology are combined. The application-oriented, but at the same time scientifically based degree program concludes with the **Bachelor's thesis**, in which students work on a subject-related topic under the guidance of a scientific supervisor. After structuring and preparing the results in writing, a presentation is given.

6.7 Mobility Window

The 4th semester (summer semester) is recommended for a stay abroad. When designing the curriculum, care was taken to ensure that the compulsory module **Food Chemistry** can alternatively be completed in the 5th or 6th semester. The partial lecture **Food Technology 2** can also be attended in the 6th semester and the module can be completed by taking the examination, as can the practical course of the 2-semester module **Microbiology**. The compulsory module **Fluid Mechanics** is a standard module that can also be completed at other technical universities. In addition, the 13 ECTS to be completed from elective modules can be taken at the host university and subsequently recognized (on application). It is expressly pointed out that 11 CP elective modules from the 6th semester must already be completed during the stay abroad (4th semester) in order to achieve the required 29 CP in the 4th semester and 30 CP in the 6th semester. The Student Advisory Service at the Campus Office is available for individual planning of the stay abroad.

7 Organization and Coordination

The bachelor's program Food Technology is offered by the TUM School of Life Sciences.

Administrative aspects of study organization are partly the responsibility of the central departments of the TUM Center for Study and Teaching (TUM CST) and partly of the TUM School of Life Sciences (see overview below):

- Student Advising: Student Advising and Information Services (TUM CST)
(via Hotline/Service Desk)
studium@tum.de
+49 (0)89 289 22245
- Departmental Student Advising: Team Student Advising
brew-food-bpt.co@ls.tum.de
Campus Office Weihenstephan
- Academic Programs Office (within department/school), Infopoint, etc: [Contact form](#) Campus Office Weihenstephan
- Study Abroad Advising/
Internationalization: TUM-wide: TUM Global & Alumni Office
internationalcenter@tum.de
Departmental: Student Counselling Team
[Contact form](#) Campus Office Weihenstephan
- Gender Equality Officer: Prof Aphrodite Kapurniotu
akapurniotu@mytum.de
- Advising – Barrier-Free Education: TUM-wide: Service Office for Disabled and Chronically Ill students and prospective students (TUM CST)
handicap@zv.tum.de
+49 (0)89 289 22737
- Admissions and Enrollment: TUM-wide: Admissions and Enrollment (TUM CST)
studium@tum.de
+49 (0)89 289 22245
Admission, Enrollment, Student Card,
Leave of Absence, re-Registration, de-Registration
- Aptitude Assessment: TUM-wide: Admissions and Enrollment (TUM CST)
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- Semester Fees and Scholarships: TUM-wide: Fees and Scholarships (TUM CST)
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- Examination Office: TUM-wide: Central Examination Office (TUM CST)
Departmental: Team Examination
examination.co@ls.tum.de
Campus Office Weihenstephan
- Examination Board: Prof. Dr.-Ing. Heiko Briesen (Chairman)
Ivan Babić (acting secretary)
- Quality Management – Academic and Student Affairs: TUM-wide: Studies and Teaching -
Quality Management (TUM CST)
www.lehren.tum.de/startseite/team-hrs/
Departmental: Team Quality Management
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8 Enhancement Measures

There were practically no changes to the current statutes, which came into force in the winter semester 2022/2023. As part of the reaccreditation of the consecutive Master's degree program carried out at this time, various changes were made to the statutes in order to harmonize the consecutive course. These amendments to the statutes are now due for reaccreditation.

In general, the conversion of the degree programs of the entire degree program bundle was characterized by enabling students to individualize their own skills profile to a greater extent. The wide range of methodological and technical skills typical of the degree program continues to serve as the basis for profiling. In addition to the mathematical and scientific competences and the specialist food technology training, the traditionally important basic engineering orientation is retained. A standardized economic education is also guaranteed.

On the other hand, the previously customary control of the acquisition of competences in the elective area has been largely dispensed with. Whereas previously certain credits always had to be selected from competence-specific catalogues, now only one elective area with profile subjects defined by the examination board is specified. For example, an industrial internship is no longer compulsory, but can of course still be included in the degree program as part of the acquisition of skills. The new structure is intended to meet the demand for graduates with a generalist education through the broad-based compulsory courses, but at the same time also to meet the increasingly differentiated professional fields for which students can prepare themselves by specifically choosing their own profile. A small proportion of credits can even be chosen completely freely from the TUM's range of courses, as long as it clearly contributes to sharpening the profile of the respective student. Of course, students still have the option of diversifying their elective subjects in order to achieve the broadest possible generalist range of competences.

As early as the 2019/2020 winter semester, the decision was made to move automation technology and process engineering (module from thermal process engineering and process engineering of disperse systems) to the Master's program. The flexibility this created in the Bachelor's degree

program was not filled with compulsory courses, but allows the above-mentioned, greater elective options as well as the improved integration of a mobility window into the degree program.

A compulsory seminar module on good scientific practice has been integrated into the interdisciplinary program, in which students are introduced to scientific work in a coordinated manner right at the beginning of their studies. The integration of a compulsory general education subject has been retained.

All changes were discussed in detail in the internal and external quality circles and received broad support from all stakeholders.