Hochschule
Albstadt-Sigmaringen
Albstadt-Sigmaringen University

Fakultät Life Sciences

Modulhandbuch
Master-Studiengang
Life Science Engineering

Studien- und Prüfungsordnung 24.1

Inhaltsverzeichnis

Semester 1

Building Information Management

<table>
<tr><td colspan="7">Module: Building Information Management</td></tr>
<tr><td colspan="2">Identification number</td><td>Workload

150 h</td><td>Type of module

PM</td><td>Study semester

1</td><td>Duration

1 Sem.</td><td>Frequency

SS</td></tr>
<tr><td>1</td><td colspan="3">Course(s)

Building Information Management</td><td>Language

german</td><td>Contact -hours

4.0 SWS / 60 h</td><td>Self -study hours

90 h</td><td>Credits (ECTS)

5.0</td></tr>
<tr><td>2</td><td colspan="7">Type of lessons / hours per week during each semester

lecture, exercises</td></tr>
<tr><td>3</td><td colspan="7">Learning outcomes / competencies:

• Comprehensive and detailed knowledge of the operation of CAD programs as well as their data formats. Comprehensive knowledge of the functional interrelationships of the different areas of industrial facilities in the life science industry. [knowledge, 7]
• Specialized technical skills in the use of CAD programs and Building Infomation Modeling (BIM). Skills to analyze and solve the functional planning contexts of industrial properties and facilities. [instrumental skills, 7]
• Present complex technical problems and solutions to experts in an articulate manner and develop these further with them. [communication, 7]
• Ability to define new application-oriented tasks and their goals, select suitable handling processes using CAD or insulation programs, and develop various solutions without detailed instructions. [reflexivity, 7]</td></tr>
</table>

Module: Building Information Management	
4	**Content:** • CAD: coordinate systems, drawing commands, change functions, layer functions and object properties, handling texts and blocks, dimensioning, plot output. • BIM: theory of integrating holistic planning, interdisciplinary planning organization and documentation, examples of BIM • Project for planning and drawing CAD- or BIM-based representation of industrial properties and facilities Recommended References: • AutoCAD - Grundlagen. Herdt Verlag (erhältlich als Download im Rahmen des Angebots “All You Can Read” zum Einsatz an staatlichen Hochschulen; Zugriff aus dem Hochschulnetz über die Webseite www.herdt-campus.de) • Baldwin, M.: Der BIM - Manager : Praktische Anwendung für das BIM - Projektmanagement, Beuth Verlag, 2017 • Eichler, C.: BIM - Leitfaden: Struktur und Funktion, Mironde Verlag • Onstott, S. : AutoCAD 2015 und AutoCAD LT 2015: Das offizielle Trainingsbuch, Sybex Verlag, 2014 • Przybylo, J.: BIM - Einstieg kompakt : Die wichtigsten BIM - Prinzipien in Projekt und Unternehmen, DIN Verlag, 2015 Ridder, D.: AutoCAD 2015 : Lernen - Üben - Anwenden, bhv Verlag, 2014 • Eastman, C., et al. : BIM Handbook - A Guide to Building Information Modeling, Hoboken: John Wiley & Sons, 2011 • IFMA Foundation, Teicholz, P. : BIM for Facility Managers. Hoboken : John Wiley & Sons, 2013
5	**Participation requirements**
6	**Type of exam:** seminar paper + presentation
7	**Requirements for granting credit points:** passed seminar paper and oral presentation
8	**Usability of the module:** also used in Life Science Innovation
9	**Name of person in charge of the module:** Schwarz, Peter, Gerhards, Christian
10	**Optional information:** May also be used as an elective module in Life Science Innovation

Business Development and Project Management

<table>
<tr><td colspan="7">Module: Business Development and Project Management</td></tr>
<tr><td colspan="2">Identification number</td><td>Workload

150 h</td><td>Type of module

PM</td><td>Study semester

1</td><td>Duration

1 Sem.</td><td>Frequency

SS</td></tr>
<tr><td>1</td><td colspan="2">Course(s)

Business Development and Project Management</td><td>Language

english</td><td>Contact -hours

4.0 SWS / 60 h</td><td>Self -study hours

90 h</td><td>Credits (ECTS)

5.0</td></tr>
<tr><td>2</td><td colspan="6">Type of lessons / hours per week during each semester

lecture, exercises</td></tr>
<tr><td>3</td><td colspan="6">Learning outcomes / competencies:
• Students will gain an understanding of the principles of business development and project management, including key concepts such as creativity & strategy development, market analysis, product development, scheduling and financial management. They will also learn about the specific challenges and opportunities of business development and project management in the life science industry. [knowledge, 7]
• Students will develop both creative but also critical thinking, problem-solving, and analytical skills. They will also improve their abilities to work in teams, present findings, and write business plans (scientific papers). They will also develop their project management skills, including planning, scheduling, monitoring, and controlling projects. [systemic skills, 7]
• Students will learn to work effectively in teams, communicate with their peers and professor, and understand the most important aspects for considerations in business development and project management. [communication, 7]
• the opportunity to work independently and to take responsibility for their own learning, as well as develop self-motivation, self-direction, and time management skills. [independency/responsibility, 7]</td></tr>
<tr><td>4</td><td colspan="6">Content:
Introduction to Business Development: Principles of business development, brainstorming techniques, market analysis, product development, and financial management.
Introduction to Project Management: Principles of project management, including planning, scheduling, monitoring, and controlling projects.
Business Development and Project Management in the Life Science Industry: Specific challenges and opportunities of business development and project management in the life science industry, including the food, pharma, and other life science industries with their specific industrial sites & facilities.
Case Studies: Real-world case studies of business development and project management in the life science industry.
Group Work: Exercise to develop a business idea and a project management plan for a real-world life science industry project.

Recommended References:
“Project Management for Engineering, Business and Technology” by J. M. Nicholas “Business Development: Prozesse, Methoden und Werkzeuge” by A. Kohne. “Handbuch Projektmanagement” by B. J. Madauss</td></tr>
<tr><td>5</td><td colspan="6">Participation requirements</td></tr>
</table>

Module: Business Development and Project Management	
6	**Type of exam:** seminar paper + presentation
7	**Requirements for granting credit points:** passed seminar paper and presentation
8	**Usability of the module:** also used in Life Science Innovation
9	**Name of person in charge of the module:** Bosch, Michael, Gerhards, Christian
10	**Optional information:**

Data Management und Digital Transition

<table>
<tr><td colspan="7">Module: Data Management und Digital Transition</td></tr>
<tr><td colspan="2">Identification number</td><td>Workload

150 h</td><td>Type of module

PM</td><td>Study semester

1</td><td>Duration

1 Sem.</td><td>Frequency

SS</td></tr>
<tr><td>1</td><td colspan="3">Course(s)

Data Management und Digital Transition</td><td>Language

english</td><td>Contact -hours

4.0 SWS / 60 h</td><td>Self -study hours

90 h</td><td>Credits (ECTS)

5.0</td></tr>
<tr><td>2</td><td colspan="6">Type of lessons / hours per week during each semester
lecture, exercises, practical course</td></tr>
<tr><td>3</td><td colspan="6">Learning outcomes / competencies:
The students gain an understanding of data communication as basis for modern technological processes and business processes. They know about the way of working of low-level bus systems up to high-level internetworking. The students know about the function and interaction of the key network components. [knowledge, 7]
The students gain an understanding how business processes are realized using standard commercial of-the-shelf (COTS) business IT systems such as Enterprise Resource Planning (ERP) and Manufacturing Execution Systems (MES). They know about business process modeling and the necessity for customization of COTS systems. [knowledge, 7]
The students gain an understanding of industrial automation by means of industrial control systems (ICS) such as Programmable Logic Controllers (PLC) and Supervisory control and data acquisition (SCADA). They understand traditional hierarchical system architectures for OT/IT integration as well as state-of-the-art approaches like Industrial IoT (IIoT with Cyber-Physical Production Systems (CPPS). [knowledge, 7]
The Students have the ability to comprehend the business processes for the planning, implementation and operation of data networks and to participate in the corresponding project phases from a principal user perspective. [assessment skills, 7]
As future engineers for technological processes in the Life Science industry the students have the ability to collaborate with IT and OT professionals in daily operations as well as project specific work. [teamwork/leadership training, 7]</td></tr>
</table>

Module: Data Management und Digital Transition	
4	**Content:** • Information Technology (IT) Systems vs. Operational Technology (OT) Systems • Business Systems and Business Processes: ERP, MES • Industrial Control Systems: PLC, SCADA, DCS, HMI • Automation and Process Control: Automatisierungspyramide, ISA-95 • Data Communication Systems and Networks, Internet, IoT • Distributed Computing: edge computing, cloud computing • Industrie 4.0, Smart Manufacturing, Industrial IoT (IIot), Cyber Physical Production Systems (CPPS) • Basic concepts of Artificial Intelligence (AI) Recommended References: • FRÜH, MAIER, SCHAUDEL : Handbuch der Prozessautomatisierung , Deutscher Industrie Verlag, 5. Auflage 2015, ISBN 978-3-8356-3372-8 • BINDEL, HOFFMANN: Projektierung von Automatisierungsanlagen, Springer Vieweg Verlag; 2. Auflage 2013, ISBN 978-3-8348-1332-9 • VDI 3694: System requirement/specification for planning and design of automation systems • VDI 3681: Classification and evaluation of description methods in automation and control technology
5	**Participation requirements**
6	**Type of exam:** written exam (90min), laboratory work
7	**Requirements for granting credit points:** passed written exam and passed laboratory work
8	**Usability of the module:** also used in Life Science Innovation
9	**Name of person in charge of the module:** Heinze, Habbo, Gerhards, Christian
10	**Optional information:**

Hygienic Processing

<table>
<tr><td colspan="7">Module: Hygienic Processing</td></tr>
<tr><td colspan="2">Identification number</td><td>Workload

150 h</td><td>Type of module

PM</td><td>Study semester

1</td><td>Duration

1 Sem.</td><td>Frequency

SS</td></tr>
<tr><td>1</td><td colspan="3">Course(s)

a. Cleanroom Technology
b. Hygienic Engineering and Design</td><td>Language

a) english
b) german</td><td>Contact -hours

4.0 SWS / 60 h</td><td>Self -study hours

90 h</td><td>Credits (ECTS)

5.0</td></tr>
<tr><td>2</td><td colspan="6">Type of lessons / hours per week during each semester
a. lecture, exercises
b. lecture, exercises</td></tr>
<tr><td>3</td><td colspan="6">Learning outcomes / competencies:
• a. Cleanroom Technology
Students will gain a comprehensive overview of qualification and validation activities in food and pharmaceutical production and related areas. They recognize that cleanroom technology is not just made up of individual disciplines, but that these are interrelated in a complex way. [knowledge, 7]
• a. Cleanroom Technology
Students can use the knowledge acquired to ensure the best possible protection of production, the economical operation of cleanroom systems and, in many cases, the protection of personnel and the environment. They understand contamination controls as effective control of the entire spectrum of hygiene measures. [assessment skills, 7]
• b. HEaD
The students are familiar with the relevant legal principles that apply to the installation and operation of factory buildings, systems and machines for hygienic production (e.g. in the food industry). The students have an in-depth knowledge of the common construction materials for machines and plants used in the food and pharmaceutical industry as well as the relevant standards for the construction of machines, plants and plant components. They understand the relevance of hygienic design for the safety and efficiency of production processes. They will have an overview of common cleaning-in-place (CIP) procedures and of the validation and certification of hygienic design. [knowledge, 7]
• b. HEaD
The students are able to assess the hygienic risks on the basis of the properties of the raw materials and the products. They will be able to define constructive measures which make it possible to control these risks. [assessment skills, 7]</td></tr>
</table>

Module: Hygienic Processing	
4	**Content:** a. Cleanroom Technology • Sources of contamination in the cleanroom • Quality control of pharmaceuticals manufactured under cleanroom conditions • Qualification of an isolator • Product protection / Employee protection • Quality management system b. HEaD • Legal regulation in the EU • Hygienic design of machinery and equipment • Materials for machines and equipment for hygienic production • Cleaning-in-place • Validation and certification of hygienic design Recommended References: a. Cleanroom Technology • Gail, L., & Gommel, U. (Eds.). (2018). *Reinraumtechnik*. 4. Aufl. Berlin, Heidelberg, New York: Springer Verlag. (in German Language) • GMP Annex 1, FDA Guide Aseptic Processing b. HEaD • Hauser, G. (2008). *Hygienegerechte Apparate und Anlagen : für die Lebensmittel-, Pharma- und Kosmetikindustrie*. Weinheim: Wiley-VCH. (in German Language) • Lelieveld, H. L. (Ed.). (2014). *Hygiene in food processing: principles and practice* [E-Book]. Woodhead Publ.
5	**Participation requirements**
6	**Type of exam:** a. seminar paper + presentation b. written exam (60min)
7	**Requirements for granting credit points:** a. passed presentation and seminar paper b. passed written exam
8	**Usability of the module:** also used in Life Science Innovation
9	**Name of person in charge of the module:** Gerhards, Christian

Module: Hygienic Processing	
10	**Optional information:** May also be used as an elective module in Life Science Innovation

Innovation Management and Consumer Centricity

<table>
<tr><td colspan="7">Module: Innovation Management and Consumer Centricity</td></tr>
<tr><td colspan="2">Identification number</td><td>Workload

150 h</td><td>Type of module

WPM</td><td>Study semester

1</td><td>Duration

1 Sem.</td><td>Frequency

SS</td></tr>
<tr><td>1</td><td colspan="3">Course(s)

Innovation Management and Consumer Centricity</td><td>Language

english</td><td>Contact -hours

4.0 SWS / 60 h</td><td>Self -study hours

90 h</td><td>Credits (ECTS)

5.0</td></tr>
<tr><td>2</td><td colspan="7">Type of lessons / hours per week during each semester

lecture, exercises</td></tr>
<tr><td>3</td><td colspan="7">Learning outcomes / competencies:

• Students understand the basics of innovation management. They learn how to organise innovation inside of companies, also including external expertise in the innovation process. They know how to take a systematic approach to innovation, from generating ideas (including different internal and external idea creation approaches) to prototyping, product development and the product launch, with a focus on the idea generation and customer-centic approaches.
Students understand the concept of innovation and the critical role customers can play in development of successful innovations
Students know different ways to access the state of ionnovation.
Students have a broad overview concerning the exploitation and protection of intellectual assets and the basic principles of Intellectual Property (IP) Management. [knowledge, 7]
• Students are able to identify, analyse and create process, product and service innovations.
Students learn to assess and optimise the approach to innovation and the potential contribution of innovation to the organisation’s sustainability.
Students apply understanding of customer needs and the adoption process to identify opportunities for innovation and new product development.
Students are able to apply different reserach strategies to capture customer information to fuel innovation [systemic skills, 7]
• Students are able to develop decision templates for the gates within the innovation process and to weigh up the risk of missing information. [assessment skills, 7]
• Students are able to plan and carry out the entire phase of idea generation in a team and to present the results in a target- and addressee-related manner. [teamwork/leadership training, 7]
• The students are able to interact B2B and B2C in ethnographic research approaches, to derive overall implications and discuss results internally as well as with external partners. [communication, 7]
• Based on current scientific findings and patent specifications, students can independently develop innovative processes for a wide variety of applications and evaluate their potential with regard to economic and ecological parameters and present them to specialist committees.
Students are able to choose the right set of ethnographic tools to derive customer centric insights and further process the data to provide innovative solutions
Students are able to provide each other with support in product optimization and to develop forward-looking, viable alternative concepts [independency/responsibility, 7]
• Students manage and prepare the pre-steps for the start of the development phase of an exemplary innovation management process based on a specific task and identify and implement suitable means for deriving customer-centic insights. [reflexivity, 7]</td></tr>
</table>

Module: Innovation Management and Consumer Centricity	
4	**Content:** The seminar provides an introduction to innovation management as an overall corporate task that allows companies to systematically identify and implement new products, processes and businesses. Based on different innovation scaling and rating options and the categorization of types and degrees of innovations, students get to know the fundamental concepts and design of innovation management and the innovation process (form initiative to implementation, based on the Stage-Gate-Process), as well as the interaction of central actors. In addition, strategic aspects and the importance of Voice-of-Customer approaches of innovation management are introduced, based on customer-centric innovation development approaches. In order to turn ideas into concrete product concepts, students are introduced to different internal and external approaches, such as creativity techniques for generating new product ideas, open innovation, lead-user approach and ethnographic research techniques. The students get an insight to the basics of Intellectual Property rights and understand the way they can protect findings of research in the form of patents and further realize full value of it by technology transfer. Based on a current research task, the ideation phase will be deepened by applying one or a set of internal and external techniques for generating product ideas in a team set-up. Recommended References: COOPER, R.; EDGETT, S.: *Product Innovation and Technology Strategy*. Surge Publishing, 2009. STREBEL, H.: *Innovations- und Technologiemanagement*. UTB, 2007. BARTHELMES, H.: *Handbuch Industrial Engineering: Vom Markt zum Produkt*. Carl Hanser Verlag GmbH, 2013. KESSLER, W.: *Prozessanalytik: Strategien und Fallbeispiele aus der industriellen Praxis*. Wiley-VCH, 2006 GABRIEL, L. et al: *Marketing und Innovation in disruptiven Zeiten*. Wiesbaden : Springer Fachmedien Wiesbaden, 2023. EVERSHEIM, W (2009): *Innovation Management for Technical Products*. ISBN: 978-3-540-85727-3 DODGSON et. al (2013): *The Oxford Handbook of Innovation Management*. Online ISBN: 9780191749865
5	**Participation requirements**
6	**Type of exam:** seminar paper + presentation
7	**Requirements for granting credit points:** passed seminar paper and oral presentation
8	**Usability of the module:** also used in Life Science Innovation
9	**Name of person in charge of the module:** Klingshirn, Astrid Christina, Gerhards, Christian
10	**Optional information:** May also be used as an elective module in Life Science Engineering

Packaging Materials and Processes

<table>
<tr><td colspan="7">Module: Packaging Materials and Processes</td></tr>
<tr><td colspan="2">Identification number</td><td>Workload

150 h</td><td>Type of module

WPM</td><td>Study semester

1</td><td>Duration

1 Sem.</td><td>Frequency

SS</td></tr>
<tr><td>1</td><td colspan="3">Course(s)

Packaging Materials and Processes</td><td>Language

english</td><td>Contact -hours

4.0 SWS / 60 h</td><td>Self -study hours

90 h</td><td>Credits (ECTS)

5.0</td></tr>
<tr><td>2</td><td colspan="7">Type of lessons / hours per week during each semester

lecture, exercises</td></tr>
<tr><td>3</td><td colspan="7">Learning outcomes / competencies:
• Students will gain an understanding of the principles of packaging materials and processes, with an emphasis on their application to the life science industry. They will learn about current trends and challenges in sustainable packaging, and the latest innovations in materials and processes. [knowledge, 7]
• Students will develop critical thinking, problem-solving, and analytical skills. They will also improve their abilities to work in teams and to present findings. [systemic skills, 7]
• Students will learn to work effectively in teams, communicate with their peers and professor, and understand the importance of sustainable packaging concepts in life science industry. [communication, 7]
• Students will have the opportunity to work independently and to take responsibility for their own learning, as well as develop self-motivation, self-direction, and time management skills. [learning competence, 7]</td></tr>
<tr><td>4</td><td colspan="7">Content:
Introduction to Packaging Materials and Processes: Principles of packaging materials and processes and their relevance to the life science industry.
Sustainable Packaging: Challenges and opportunities for sustainable packaging, including issues related to materials and processes, recycling, and waste management.
Excursions to the Sustainable Packaging Institute (SPI): Visit the SPI and learning about the latest trends and innovations in sustainable packaging.
Packaging Materials and Processes in the Life Science Industry: Specific challenges and opportunities for packaging materials and processes in the life science industry, including the food, pharma, and other life science industries.
Group Work: Research and analysis of a specific topic related to packaging materials and processes in the life science industry.

Recommended References:

• Lee, D. S., Yam, K., & Piergiovanni, L. (2008). Food Packaging Science and Technology (1st ed.). CRC Press.</td></tr>
<tr><td>5</td><td colspan="7">Participation requirements</td></tr>
<tr><td>6</td><td colspan="7">Type of exam:

oral exam (15min)</td></tr>
</table>

Module: Packaging Materials and Processes	
7	**Requirements for granting credit points:** passed oral exam
8	**Usability of the module:** also used in Life Science Innovation
9	**Name of person in charge of the module:** Schmid, Markus, Gerhards, Christian
10	**Optional information:** May also be used as an elective module in Life Science Engineering

Related Degree Programmes

Module: Related Degree Programmes					
Identification number	**Workload**	**Type of module**	**Study semester**	**Duration**	**Frequency**
	150 h	WPM	1 (LSE) 2 (LSE)	1 Sem.	SS (LSE) WS (LSE)

	Course(s)	**Language**	**Contact -hours**	**Self -study hours**	**Credits (ECTS)**
1	Related Degree Programmes	german & english	4.0 SWS / 60 h	90 h	5.0

2	**Lehrform(en) / SWS** depending on chosen activity
3	**Learning outcomes / competencies:** • Learning outcomes / competencies will depend on the module/courses chosen. They must fit to the level of the master's degree and are subject of approval by the dean of studies. [knowledge, 7][instrumental skills, 7][systemic skills, 7][assessment skills, 7][teamwork/leadership training, 7][participation, 7][communication, 7][independency/responsibility, 7][reflexivity, 7][learning competence, 7]
4	**Content:** depending on the chosen module/course
5	**Participation requirements**
6	**Type of exam:** depending on chosen module
7	**Requirements for granting credit points:** passed exams as defined by the module/course description
8	**Usability of the module:** also used in Life Science Innovation
9	**Name of person in charge of the module:** Schmid, Andreas, Gerhards, Christian
10	**Optional information:** Any additional module/course with adequate level of learning outcomes / competencies may be chosen. To get this module approved, an informal application must be submitted to the examination office. It is the responsibility of the dean of studies to approve the chosen module/course.

Supply Engineering

<table>
<tr><td colspan="7">Module: Supply Engineering</td></tr>
<tr><td colspan="2">Identification number</td><td>Workload

150 h</td><td>Type of module

PM</td><td>Study semester

1</td><td>Duration

1 Sem.</td><td>Frequency

SS</td></tr>
<tr><td>1</td><td colspan="3">Course(s)

Supply Engineering</td><td>Language

german</td><td>Contact -hours

4.0 SWS / 60 h</td><td>Self -study hours

90 h</td><td>Credits (ECTS)

5.0</td></tr>
<tr><td>2</td><td colspan="6">Type of lessons / hours per week during each semester

lecture, exercises</td></tr>
<tr><td>3</td><td colspan="6">Learning outcomes / competencies:

• Comprehensive, detailed and specialized knowledge of the technical structures of the media, supply and installation technology required for production and buildings in the Life Sciences industry. Knowledge of planning processes and the integration of media into building structures. [knowledge, 7]
• Conceptual skills for the development of media, supply and installation structures in the Life Sciences industry and to analyze and optimize existing installations. Incorporation of the life cycle to ensure economical and sustainable operation. [systemic skills, 7]
• Ability to develop and responsibly manage the organization for the various subject-specific stakeholders of a supply and installation structure, as well as to lead interdisciplinary discussions and present the results of the work. [teamwork/leadership training, 7]</td></tr>
</table>

Module: Supply Engineering	
4	**Content:** A. General principles - Building plans and representation rules B. Basics of building structures - Grid and modular dimensions - Static systems for production halls and warehouses - Structural design of industrial buildings - Construction costs - Integration of technical equipment in building structures C. Water supply - Basics - Water conditioning and treatment processes - Water distribution - Water heating and distribution - Planning of water supply systems D. Drainage - Drainage systems - Drainage pipes - Special systems for industrial wastewater E. Ventilation technology - Composition and conditions of air - Air volume calculation - Systems of air handling units - Parts of air handling systems - Air flow in the room - Control devices for ventilation systems F. Clean room technology - Fields of application of clean room technology - Types of contamination - Cleanroom classes - Fluidic considerations - Cleanroom concepts - Cleanroom components - Air filtration - Energy optimization of cleanrooms - Product protection and occupational safety - Quality management in cleanroom technology G. Steam and condensate technology - Physical basics of steam technology - Dimensioning and laying of steam lines - Venting and drainage - Pressure and temperature control - Basics of steam traps - Steam trap monitoring - Dimensioning of condensate lines - Flash tank and steam tracing - Condensate recirculation - Pure steam types Recommended References: Bendlin, H., & Eßmann, M. (2011). *Reinstwasser – Planung, Realisierung, Qualifizierung von Reinstwassersystemen, 2.Aufl*. Schopfheim: GMP-Verlag. Bischof, W. (2024). *Abwassertechnik, 12. überarb. Aufl*. Stuttgart: Vieweg + Teubner Springer Vieweg. Gail, L., & Gommel, U. (2018). *Reinraumtechnik. 4. Auf*l. (L. Gail, & H.-P. Hortig, Hrsg.) Berlin, Heidelberg, New York: Springer Verlag. Hörner, B., & Schmidt, M. (2012). *Handbuch der Klimatechnik*. Band 1: Grundlagen, Band 2: Anwendungen, Band 3: Aufgaben und Lösungen. VDE Verlag. Karger, R., & et al. (2012). *Wasserversorgung, 14. Aufl*. Wiesbaden. Keller, L. (2014). *Leitfaden für Lüfungs- und Klimaanlagen, 3. Aufl*. Verlag Recknagel. Kistemann, T., & et al. (2012). *Gebäudetechnik für Trinkwasser*. Berlin, Heidelberg, New York: Springer. Pistohl, W. (2016). *Handbuch der Gebäudetechnik, Band 1 und 2, 9.Aufl*. Werner Verlag. Recknagel, H., & et al. (2017). *Taschenbuch für Heizung+Klimatechnik 17/18*. Deutscher Industrieverlag. Röder, F. (2016). *Pharmawasser-Systeme wirtschaftlich betreiben : Reinstwasser für Herstellung und Labor*. GMP Verlag. Röder, F. (2017). *Pharmawasser - Inhaltsstoffe, Grenzwerte und Anlagenkonzepte*. GMP Verlag. Röder, F. (2018). *Auslegung, Installation und Qualifizierung von Pharmawasser-Systemen: Reinstwasser für Herstellung und Labor*. GMP Verlag. Schneider, U. (2014). *Baulicher Brandschutz im Industriebau*. Berlin. Veit, J. (2013). *Gebäudetechnik 2014: erneuerbare Energien, Gebäudeautomation, Energieeffizienz*. Hüthig Verlag. Weissiecker, H., & Kriegel, M. (2018). *Projektplanung Reinraum- und Reinheitstechnik.* VDE-Verlag.
5	**Participation requirements**
6	**Type of exam:** written exam (120min)
7	**Requirements for granting credit points:** passed written exam.
8	**Usability of the module:** siehe Modulart
9	**Name of person in charge of the module:** Gerhards, Christian

Module: Supply Engineering	
10	**Optional information:**

Semester 2

Case Study

<table>
<tr><td colspan="8">Module: Case Study</td></tr>
<tr><td colspan="2">Identification number</td><td>Workload

150 h</td><td>Type of module

PM</td><td>Study semester

2</td><td>Duration

1 Sem.</td><td colspan="2">Frequency

WS</td></tr>
<tr><td>1</td><td colspan="3">Course(s)

Case Study</td><td>Language

german</td><td>Contact -hours

4.0 SWS / 60 h</td><td>Self -study hours

90 h</td><td>Credits (ECTS)

5.0</td></tr>
<tr><td>2</td><td colspan="7">Lehrform(en) / SWS

lecture, exercises</td></tr>
<tr><td>3</td><td colspan="7">Learning outcomes / competencies:
• Students will learn the systematic approach in production site planning, either for greenfield (new design) or brownfield (redesign) projects. They will also learn about the latest trends and innovations in material flow modeling. [knowledge, 7]
• Students will develop critical thinking, problem-solving, and analytical skills. They will also improve their abilities to work in teams and to present their findings. [systemic skills, 7]
• Students will learn to work effectively in teams, communicate with their peers and professor, and understand to communicate with representatives of various professions involved in production site planning. [communication, 7]
• Students will have the opportunity to work on their own and to take responsibility for their own learning results, as well as to develop self-motivation, self-direction, and time management skills. [independency/responsibility, 7]
• Students will apply the principles of production site planning in a conceptual design, including design of ideal and real layout, material and personnel flows, interfaces, location, infrastructure and media supply. [instrumental skills, 7]</td></tr>
<tr><td>4</td><td colspan="7">Content:
Production Site Planning in the Life Science Industry: Specific challenges and opportunities for production site planning in the food, pharmaceutical, and other life science industries.
Introduction to the process simulation Witness: Basics, optimization goals and objectives, boundary values within models and will exercise with predefined examples.
Group Work: Students will work in groups to prepare an individual conceptual design regarding a live science facility. For example they will compare different layouts, to make an optimal choice for the final design.
Presentation and Communication: Students will learn how to present their concepts, both orally and in written form and how to communicate effectively with their colleagues and professor.</td></tr>
<tr><td>5</td><td colspan="7">Participation requirements</td></tr>
<tr><td>6</td><td colspan="7">Type of exam:

seminar paper + presentation</td></tr>
<tr><td>7</td><td colspan="7">Requirements for granting credit points:

passed seminar paper and oral presentation</td></tr>
<tr><td>8</td><td colspan="7">Usability of the module:</td></tr>
</table>

Module: Case Study	
	siehe Modulart
9	**Name of person in charge of the module:** Grothe, Enrico, Gerhards, Christian
10	**Optional information:**

Food Service Design and Management

<table>
<tr><td colspan="7">Module: Food Service Design and Management</td></tr>
<tr><td colspan="2">Identification number</td><td>Workload

150 h</td><td>Type of module

WPM</td><td>Study semester

2</td><td>Duration

1 Sem.</td><td>Frequency

WS</td></tr>
<tr><td>1</td><td colspan="3">Course(s)

Food Service Design and Management</td><td>Language

german</td><td>Contact -hours

4.0 SWS / 60 h</td><td>Self -study hours

90 h</td><td>Credits (ECTS)

5.0</td></tr>
<tr><td>2</td><td colspan="6">Type of lessons / hours per week during each semester

lecture, exercises</td></tr>
<tr><td>3</td><td colspan="6">Learning outcomes / competencies:
• Students will have a comprehensive, up-to-date working knowledge of commercial kitchen design and relevant concepts. [knowledge, 7]
• Students will be able to develop solutions for commercial kitchens for the specific task at hand (production, logistics). [systemic skills, 7]
• Students represent their expertise in committees in which the various trades (fire protection, building installations, structural engineering, media supply, …) are represented. [communication, 7]
• Students work out the respective solutions and concepts independently. [independency/responsibility, 7]</td></tr>
</table>

Module: Food Service Design and Management	
4	**Content:** -Directives, ordinances Laws -EU food hygiene package -EU approval -Key figures, determination of requirements -EDP in the out-of-home economy -Energy in the commercial kitchen (calculation methods for energy costs; energy requirements in the GK; energy sources; energy management systems) -Economic aspects in GK planning -Supply task, range of services -Kitchen types; kitchen types -food production and food distribution systems -post-processing and serving -place of assembly ordinance -design of the catering area -workplace ordinance, personnel, social and sanitary areas -personnel requirements -building technology (floors and construction technology; ventilation technology; sanitary and gas technology; water requirements and water quality, water hardness; water installation technology; waste water technology) -electrical technology (symbols, connected load, protection types) -lighting -fire protection technology Processing of the following task: Development of a concrete project planning on the basis of the service phases of HOAI Part IX (services for technical equipment). On the basis of these service phases, the students are taught the fundamentals and planning specifications that build on one another. The exercise part of the course is thus basically divided into nine planning phases: In phase 1, the students learn general basics in the form of laws, standards and guidelines for the area of equipment planning in communal catering establishments. Furthermore, planning-specific basics are worked out. In phase 2, an initial preliminary plan is drawn up on the basis of the fundamentals identified. The students will be taught how to implement the principles developed into a room concept, taking into account the current specifications. The implementation takes place in the form of a further practical study work parallel to the lecture. This space planning is created with the help of a CAD system. The course contains practical instructions on how to work with this system. Phase 3 is used to convert the preliminary planning into a design planning. The students learn more about the requirements for the equipment of a communal catering operation. Knowledge of equipment technology is further deepened and implemented in the planning. Here, too, implementation then takes place in a third and final part as practical course work in the form of design planning with CAD. Phase 4 is used to familiarize the students with constructional and official requirements for communal catering establishments. Phase 5 deals with the technical building requirements of a communal catering operation. The students learn how to prepare a detailed design. In phases 6 and 7, the specifications for the preparation and processing of a performance specification are presented. The various legal bases in the tendering system are given high priority. The use of AVA programs is explained. Phases 8 and 9 deal with important points in construction management using the practical construction supervision of a project as an example. This phase is supplemented and deepened by excursions in which ongoing construction projects and completed projects are visited. In addition, relevant standards, regulations and guidelines (both from the legislator and from various associations such as professional associations, VDI, VDE, …) and the various interfaces in connection with commercial kitchen planning are addressed. Recommended References: SCHWARZ P. u. a. (2010): Großküchen, Planung Entwurf Einrichtung (5. Auflage). Berlin: Verlag für Bauwesen (Huss Medien). ISBN-10: 3345009293 oder ISBN-13: 978-3345009297 . SCHWARZ P. et. al. (2013): Professional Kitchens (6th edition). Berlin: Huss-Medien GmbH. GREINER M., ANDREÄ J., HAGSPIHL S. et. al. (2020): Küche und Technik - Handbuch für gewerbliche Küchen Teil I und Teil II ISSN 2626-0913
5	**Participation requirements**
6	**Type of exam:** written exam (90min), seminar paper
7	**Requirements for granting credit points:** passed written exam and passed seminar paper

Module: Food Service Design and Management	
8	**Usability of the module:** also used in Life Science Innovation
9	**Name of person in charge of the module:** Schwarz, Peter, Gerhards, Christian
10	**Optional information:** May be used as an elective module in Life Science Engineering and in Life Science Innovation

Life Science Logistics

Module: Life Science Logistics					
Identification number	**Workload** 150 h	**Type of module** PM	**Study semester** 2	**Duration** 1 Sem.	**Frequency** WS

	Course(s)	**Language**	**Contact -hours**	**Self -study hours**	**Credits (ECTS)**
1	Life Science Logistics	german	4.0 SWS / 60 h	90 h	5.0

2	**Type of lessons / hours per week during each semester** lecture, exercises
3	**Learning outcomes / competencies:** • Students will gain an in-depth understanding of the principles of logistics and supply chain management in the Life Sciences Industry. They will learn about the specific challenges, opportunities and software applications of logistics in the Life Sciences Industry, including the food, pharmaceutical, and other life sciences industries. They will also learn about lean management methods and how they can be applied to logistics operations. [knowledge, 7] • Students will develop critical thinking, problem-solving, and analytical skills. They will also improve their abilities to work in teams and to present their findings. They will also develop skills in logistics planning, inventory management, and transportation management. [systemic skills, 7] • Students will learn to communicate effectively in teams, with their peers and professor, and understand the ethical considerations involved in logistics operations. [communication, 7] • Students will have the opportunity to work on their own and to take responsibility for their own learning results, as well as to develop self-motivation, self-direction, and time management skills. [independency/responsibility, 7]

Module: Life Science Logistics	
4	**Content:** • Part 1: Internal production site logistics: Principles of internal logistics in the context of production site operations including inventory management, material handling, weighing centrals, conveying centers and production scheduling. • Part 2: External logistics: Principles of logistics and supply chain management in the context of external operations, including transportation management, logistics planning, and distribution. • Lean management methods: Value stream mapping and how it can be applied to facility operations to improve efficiency and reduce waste. • Case Studies: Students will analyze real-world case studies of logistics operations in the life science industry. • Group Work: Students will work in groups to develop a logistics plan for a real-world life science industry project. Recommended References: Kiesel J, *Dictionary of Logistics and Supply Chain Management*, Siemens AG Erlangen Rother M, Shook J, *Learning to See - Value Steam Mapping to add Value*, www.lean.org Rother M, Shook J, *Sehen Lernen - mit Wertstromdesign die Wertschöpfung erhöhen und Verschwendung beseitigen*, Aachen LMI Womack J P, Jones D T, *Lean Thinking*, Campus Frankfurt/New York Schneider M, *Lean Factory Design*, Hanser Muchna C, *Grundlagen der Logistik – Begriffe, Strukturen, Prozesse*, Springer Kummer S, O. Grün O, Jammernegg W, *Grundzüge der Beschaffung, Produktion und Logistik* Kummer S, O. Grün O, Jammernegg W, *Grundzüge der Beschaffung, Produktion und Logistik - Das Übungsbuch*
5	**Participation requirements**
6	**Type of exam:** written exam (120min)
7	**Requirements for granting credit points:** passed written exam
8	**Usability of the module:** also used in Life Science Innovation
9	**Name of person in charge of the module:** Grothe, Enrico, Gerhards, Christian
10	**Optional information:** May also be used as an elective module in Life Science Innovation

Planning of Research Proposals and Scientific Writing

<table>
<tr><td colspan="7">Module: Planning of Research Proposals and Scientific Writing</td></tr>
<tr><td colspan="2">Identification number</td><td>Workload

150 h</td><td>Type of module

WPM</td><td>Study semester

2</td><td>Duration

1 Sem.</td><td>Frequency

WS</td></tr>
<tr><td>1</td><td colspan="2">Course(s)

Planning of Research Proposals and Scientific Writing</td><td>Language

english</td><td>Contact -hours

4.0 SWS / 60 h</td><td>Self -study hours

90 h</td><td>Credits (ECTS)

5.0</td></tr>
<tr><td>2</td><td colspan="6">Type of lessons / hours per week during each semester

lecture, exercises</td></tr>
<tr><td>3</td><td colspan="6">Learning outcomes / competencies:
• Students will gain an understanding of the principles of writing research proposals and scientific papers, including the structure, content, and style of these documents. They will also learn about the different types of research funding and publication opportunities available in their field. [knowledge, 7]
• Students will develop critical thinking, problem-solving, and analytical skills. They will also improve their abilities to write clearly, persuasively, and accurately, and to present their research effectively. [systemic skills, 7]
• Students will learn to work effectively in teams, communicate with their peers and professor, and understand the ethical considerations involved in scientific writing. [participation, 7]
• Students will have the opportunity to work independently and to take responsibility for their own learning, as well as develop self-motivation, self-direction, and time management skills. [independency/responsibility, 7]</td></tr>
<tr><td>4</td><td colspan="6">Content:
Introduction to Research Proposal Writing: Structure and content of research proposals, and the different types of research funding available.
Writing Scientific Papers: Structure and content of scientific papers, and the different types of publication opportunities available.
Group Work: Students will work in groups to research and analyze a specific topic related to writing research proposals. The group work should result in a proposal for a real call as performance record for this module.
Presentation and Communication: Students will learn how to present their research proposals and scientific papers effectively, both verbally and in written form, and how to communicate effectively with their peers and professor.

Recommended References:
“The Craft of Scientific Writing” by Michael Alley “Drittmittel für die Forschung. Grundlagen: Erfolgsfaktoren und Praxistipps für des Schreiben von Förderanträgen” by S. Preuß (will be provided in excerpts in English language)</td></tr>
<tr><td>5</td><td colspan="6">Participation requirements</td></tr>
<tr><td>6</td><td colspan="6">Type of exam:

seminar paper + presentation</td></tr>
<tr><td>7</td><td colspan="6">Requirements for granting credit points:

passed seminar paper and oral presentation</td></tr>
</table>

Module: Planning of Research Proposals and Scientific Writing	
8	**Usability of the module:** also used in Life Science Innovation
9	**Name of person in charge of the module:** Schmid, Markus, Gerhards, Christian
10	**Optional information:** May also be used as an elective module in Life Science Engineering

Production Processes and Advanced Technologies

Module: Production Processes and Advanced Technologies					
Identification number	**Workload**	**Type of module**	**Study semester**	**Duration**	**Frequency**
	150 h	PM	2	1 Sem.	WS

	Course(s)	**Language**	**Contact -hours**	**Self -study hours**	**Credits (ECTS)**
1	Production Processes and Advanced Technologies	english	4.0 SWS / 60 h	90 h	5.0

2	**Type of lessons / hours per week during each semester** lecture, exercises
3	**Learning outcomes / competencies:** • Students will gain an understanding of processes in the life science industry. They will learn about current trends and challenges in the areas of food, pharma, and other life science industries. [knowledge, 7] • Students will develop critical thinking, problem-solving, and analytical skills. They will also improve their abilities to work in teams and to present findings [systemic skills, 7] • Students will have the opportunity to work independently and to take responsibility for their own learning, as well as develop self-motivation, self-direction, and time management skills. [independency/responsibility, 7]
4	**Content:** Production processes: * Graphical representation of procedural processes * Selected production processes and equipment * Breakdown of production processes into necessary process steps (unit operations) Advanced technologies: The course provides theoretical and practical knowledge about new technologies, e.g.: * Extrusion and dispersion methods * Gentle preservation processes (HPP, PEF, MF / RF-heating) * Food irradiation * Antimicrobial packaging / coatings, ozone / UV treatment Recommended References: Clark, J. Peter: *Case Studies in Food Engineering* (Springer Science & Business Media) ISBN 978-1-4419-0419-5 1. Auflage, 2009
5	**Participation requirements**
6	**Type of exam:** presentation, written exam (120min)
7	**Requirements for granting credit points:** passed presentation and passed written exam
8	**Usability of the module:** also used in Life Science Innovation
9	**Name of person in charge of the module:** Köhler, Karsten, Gerhards, Christian
10	**Optional information:**

Production Site Planning

<table>
<tr><td colspan="7">Module: Production Site Planning</td></tr>
<tr><td colspan="2">Identification number</td><td>Workload

150 h</td><td>Type of module

PM</td><td>Study semester

2</td><td>Duration

1 Sem.</td><td>Frequency

WS</td></tr>
<tr><td>1</td><td colspan="3">Course(s)

Production Site Planning</td><td>Language

english</td><td>Contact -hours

4.0 SWS / 60 h</td><td>Self -study hours

90 h</td><td>Credits (ECTS)

5.0</td></tr>
<tr><td>2</td><td colspan="7">Type of lessons / hours per week during each semester

lecture, exercises</td></tr>
<tr><td>3</td><td colspan="7">Learning outcomes / competencies:
• Students will gain an understanding of the principles of production site planning, including the factors that must be considered when planning a production site, such as location, infrastructure, and environmental impact. They will also learn about the latest trends and innovations in sustainable production site planning in the life science industry. [knowledge, 7]
• Students will develop critical thinking, problem-solving, and analytical skills. They will also improve their abilities to work in teams and to present findings. [systemic skills, 7]
• Students will learn to work effectively in teams, communicate with their peers and professor, and understand to communicate with interfaces of all trades involved in production site planning. [communication, 7]
• Students will have the opportunity to work independently and to take responsibility for their own learning, as well as develop self-motivation, self-direction, and time management skills. [independency/responsibility, 7]</td></tr>
<tr><td>4</td><td colspan="7">Content:
Introduction to Production Site Planning: Principles of production site planning and the factors that must be considered when planning a production site.
Sustainable Production Site Planning: Challenges and opportunities for sustainable production site planning, including issues related to location, infrastructure, and environmental impact.
Production Site Planning in the Life Science Industry: Specific challenges and opportunities for production site planning in the life science industry, including the food, pharma, and other life science industries.
Group Work: Students will work in groups to research and analyze a specific topic related to production site planning in the life science industry.
Presentation and Communication: Students will learn how to present their research findings, both verbally and in written form, and how to communicate effectively with their peers and professor.

Recommended References:
Wiendahl, H.-P., Reichardt, J., & Nyhuis P. (2014). Handbuch Fabrikplanung: Konzept, Gestaltung und Umsetzung wandlungsfähiger Produktionsstätten Carl Hanser Verlag GmbH & Co. KG</td></tr>
<tr><td>5</td><td colspan="7">Participation requirements</td></tr>
<tr><td>6</td><td colspan="7">Type of exam:

oral exam (20min)</td></tr>
<tr><td>7</td><td colspan="7">Requirements for granting credit points:

passed oral exam.</td></tr>
</table>

Module: Production Site Planning	
8	**Usability of the module:** siehe Modulart
9	**Name of person in charge of the module:** Schmid, Markus, Gerhards, Christian
10	**Optional information:**

Standardization and Regulation in Life Science Industry

<table>
<tr><td colspan="7">Module: Standardization and Regulation in Life Science Industry</td></tr>
<tr><td colspan="2">Identification number</td><td>Workload

150 h</td><td>Type of module

WPM</td><td>Study semester

2</td><td>Duration

1 Sem.</td><td>Frequency

WS</td></tr>
<tr><td>1</td><td colspan="2">Course(s)

Standardization and Regulation in Life Science Industry</td><td>Language

english</td><td>Contact -hours

4.0 SWS / 60 h</td><td>Self -study hours

90 h</td><td>Credits (ECTS)

5.0</td></tr>
<tr><td>2</td><td colspan="6">Type of lessons / hours per week during each semester

lecture, exercises</td></tr>
<tr><td>3</td><td colspan="6">Learning outcomes / competencies:

• Students understand the basics of standardisation - including the relevancy, involved parties and the key processes with a focus on European and national standardisation.
Students know the different usages of standardisation and the techniques applied in standardisation, the need to comply with standards and regulations for different marketplaces and the interplay between innovation, intellectual property, and standards.
Students know the key process of setting up a standard.
Students know how to identify and apply regulations, standards, specifications and other relevant documents for products, systems or services and how to ensuring the conformity of products.
Students understand the regulations for market access and marketability for food and pharmaceutical products - including the relevancy, involved parties and the key processes with focus on European and national regulation/legislation. [knowledge, 7]
• Students are able to identify the role of standards (including management systems standards) and regulations in the development of products, services, processes.
Students know how to determining the quality, environment, safety, energy, sustainability and social responsibility requirements related to standards / standardisation.
Students are able to apply regulations and standards in development processes, in testing processes and procedures, to identify and ensure conformity assessment systems and to facilitate the implementation of management systems and continually improving their effectiveness. [systemic skills, 7]
• Students unterstand the need and the value of compliance with standards and regulations in a competitive world marketplace.
Students can access the role of standards in management systems and policies and the strategic importance of regulation and standardization committee work. [assessment skills, 7]
• Students have an understanding how to participate in the standardization process.
Students know how to influence the contents of standards & technical regulations and how to contribute to business intelligence in standardization. [participation, 7]
• Based on examples from consumer products the students are able to assess limitations of existing standards and regulations and are able to provide improvement options. [reflexivity, 7]</td></tr>
</table>

Module: Standardization and Regulation in Life Science Industry	
4	**Content:** **STANDARDISATION** The seminar covers the following topics: **Standardization in Germany:** Standards organization DIN, VDE/DKE; structure of these organizations; Contract of Federal Republic of Germany with DIN; role of electrotechnical standardization (VDE); government and standardization **How a standard is developed:** Rules and requirements (e.g. WTO); DIN 820 series; 10 standardization principles; processes; the document itself **International and European Standardization:** ISO, IEC, ITU, CEN, CENELEC, ETSI; structure and working principles; regional standards organizations; fora and consortia **How standardization works:** Overview how standardization organization interact with each other; technological and geopolitical aspects; standardization power houses and follower **Standardization and the legal framework:** How standards are used in National and European legislation; European directives and regulations; New Legislative Framework (NLF); market access; Conformity Assessment; CE marking **Testing and Certification:** Role of standards for testing and certification; processes for testing and certification, European and International conformity assessment systems; accreditation; reproduceability; calibration **Digitalisation**: Digitalisation of standardization; digital standards; Standardization of the digitalization; Tools and platforms In the **practical session** one key process of standardisation is reviewed / elaborated, from the basic set-up of a standard or technical specification draft, to implementing a standard in a laboratory setting, to analysing the repeatability / reproducibility of a given standard test procedure. **REGULATION** The lecture provides an understanding of market access and marketability for food and pharmaceutical products. It addresses the definition and demarcation of food versus dietary supplements versus pharmaceutical products. The working methods of committees, associations and authorities in the context of innovation of these product groups are discussed. The context of european legislation compared to national legislation is conveyed and the main regulatory requirements are shown. A specific focus is set on the communication and compliance with – increasingly significant – additional standards along the food value chain. Recommended References: Spivak S, Brenner F (2001): Standardization Essentials: Principles and Practice.CRC Press.ISBN-10: 0824789180. Jakobs K (2019): Shaping the Future Through Standardization. DOI: 10.4018/978-1-7998-2181-6 Mak V (2020): More Normativity: Standardization. Legal Pluralism in European Contract Law, Oxford Studies in European Law. Oxford Academic. DOI: 10.1093/oso/9780198854487.003.0008 van der Meulen B & Wernaart B (2020): EU Food law Handbook, European Institute for Food Law series, Volume 13, ISBN: 978-90-8686-350-1
5	**Participation requirements**
6	**Type of exam:** oral exam (20min), portfolio
7	**Requirements for granting credit points:** passed oral exam and passed portfolio
8	**Usability of the module:** also used in Life Science Innovation
9	**Name of person in charge of the module:** Klingshirn, Astrid Christina, Gerhards, Christian
10	**Optional information:** May also be used as an elective module in Life Science Engineering

Sustainability

<table>
<tr><td colspan="7">Module: Sustainability</td></tr>
<tr><td colspan="2">Identification number</td><td>Workload

150 h</td><td>Type of module

PM</td><td>Study semester

2</td><td>Duration

1 Sem.</td><td>Frequency

WS</td></tr>
<tr><td>1</td><td colspan="3">Course(s)

Sustainability</td><td>Language

english</td><td>Contact -hours

4.0 SWS / 60 h</td><td>Self -study hours

90 h</td><td>Credits (ECTS)

5.0</td></tr>
<tr><td>2</td><td colspan="6">Type of lessons / hours per week during each semester
lecture, exercises</td></tr>
<tr><td>3</td><td colspan="6">Learning outcomes / competencies:
• Students will gain an understanding of the principles of sustainability and their application to the life science industry. They will learn about current trends and challenges in the areas of food, pharma, and other life science industries. [knowledge, 7]
• Students will develop critical thinking, problem-solving, and analytical skills. They will also improve their abilities to work in teams and to present findings. [systemic skills, 7]
• Students will learn to work effectively in teams, communicate with their peers and professor, and understand the ethical considerations involved in sustainable life science industry. [teamwork/leadership training, 7]
• Students will have the opportunity to work independently and to take responsibility for their own learning, as well as develop self-motivation, self-direction, and time management skills. [independency/responsibility, 7]</td></tr>
<tr><td>4</td><td colspan="6">Content:
Introduction to Sustainability: Principles of sustainability and their relevance to the life science industry, including current legal and regulatory trends.
Sustainability in the Food Industry: Challenges and opportunities for sustainability in the food industry, including issues related to food production, processing, packaging and distribution.
Sustainability in the Pharmaceutical Industry: Challenges and opportunities for sustainability in the pharmaceutical industry, including issues related to drug development and manufacturing.
Sustainability in other Life Science Industries: Challenges and opportunities for sustainability in other life science industries, such as the biotechnology and medical device industries.
Group Work: Students will work in groups to research and analyze a specific topic related to sustainability in the life science industry. The group work should result in a presentation.
Presentation and Communication: Students will learn how to present their research findings, both verbally and in written form, and how to communicate effectively with their peers and professor.

Recommended References:
Muschett, F. D. (2017).* Principles of Sustainable Development*. CRC Press.
Please note that these are just examples and the actual literature used in the module may vary depending on the chosen topic.</td></tr>
<tr><td>5</td><td colspan="6">Participation requirements</td></tr>
<tr><td>6</td><td colspan="6">Type of exam:
seminar paper + presentation</td></tr>
</table>

Module: Sustainability	
7	**Requirements for granting credit points:** passed seminar paper and presentation
8	**Usability of the module:** also used in Life Science Innovation
9	**Name of person in charge of the module:** Schmid, Markus, Gerhards, Christian
10	**Optional information:**

Semester 3

Master's Thesis

<table>
<tr><td colspan="7">Module: Master's Thesis</td></tr>
<tr><td colspan="2">Identification number</td><td>Workload

900 h</td><td>Type of module

PM</td><td>Study semester

3</td><td>Duration

1 Sem.</td><td>Frequency

WS und SS</td></tr>
<tr><td>1</td><td colspan="3">Course(s)

a. Defense of the Master's Thesis
b. Master's Thesis</td><td>Language

a) german & english
b) english</td><td>Contact -hours

0.5 SWS / 360 h</td><td>Self -study hours

540 h

Credits (ECTS)

30.0</td></tr>
<tr><td>2</td><td colspan="6">Type of lessons / hours per week during each semester
a. (keine)
b. project work</td></tr>
<tr><td>3</td><td colspan="6">Learning outcomes / competencies:
• The knowledge already acquired in the preceding bachelor's degree program and the largely completed master's program is systematically augmented by specific knowledge in order to fulfill the task. [knowledge, 7]
• When working on the master's thesis, the student should demonstrate that he/she is able to work independently and scientifically on an issue that is typical for the later professional field under the following aspects: - research and acquisition of the necessary scientific literature as well as critical sifting - clear structuring and selection, as well as application of suitable methods - interdisciplinary processing of what has been learned so far and application to a new or innovative problem - written presentation of the results in an accurate form, which meets all criteria of a scientific writing. [systemic skills, 7]
• It is the responsibility of the student to use the necessary means of communication to plan the Master's thesis in terms of content and time, to hold interim meetings, and to inform the examiner/supervisor in a timely and comprehensive manner in the event of difficulties and delays. [communication, 7]
• It is the student's responsibility to complete the assigned task comprehensively and in a timely manner, and to present the results. [independency/responsibility, 7]</td></tr>
<tr><td>4</td><td colspan="6">Content:
In the master's thesis, the student works on a clearly outlined and relevant task, which is linked to one or more modules of the study program. study program. The task for the master's thesis preferably results from the main areas of work of one or more lecturers and/or from a task of a relevant company. Ideally, it should be typical for the task of the intended future professional field of work.

Recommended References:
Faculty of Life Sciences. (no date). Guidelines for professional scientific writing. Hochschule Albstadt-Sigmaringen [internal document, not published].
Winkler, G., & Möller, C. (no date). Kleiner Leitfaden für gute Präsentationen. Hochschule Albstadt-Sigmaringen [internal document, not published] (in German language)</td></tr>
<tr><td>5</td><td colspan="6">Participation requirements</td></tr>
<tr><td>6</td><td colspan="6">Type of exam:
a. master's thesis
b. master's thesis</td></tr>
</table>

Module: Master's Thesis	
7	**Requirements for granting credit points:** passed master's thesis and passed defense of the master's thesis
8	**Usability of the module:** also used in Facility and Process Design, Life Science Innovation
9	**Name of person in charge of the module:** Gerhards, Christian
10	**Optional information:** Topics for the master's thesis are issued by all faculty members. Students can contact the lecturers in their search for topics or apply to relevant companies for an external master's thesis. The topic, content and scope of an external master's thesis must be approved by a professor of the Albstadt-Sigmaringen University of Applied Sciences, who then acts as an internal supervisor and 1st examiner. The master thesis is evaluated by two examiners, at least one of whom must be a professor of the Albstadt-Sigmaringen University. In the case of an external master's thesis, the 2nd examiner may be an employee of a relevant company with an academic degree equivalent to the Master's degree. Details on the examination and evaluation of the master's thesis and its defense can be found in the current 'study and examination regulations' (Studien- und Prüfungsordnung) of the Albstadt-Sigmaringen University. .

Studiengangs-Kompetenzmatrix

Studiengang: Life Science Engineering
StuPO-Version: 24.1

	Fachkompetenz				**Personale Kompetenz**					
	Wissen	**Fertigkeiten**			**Sozialkompetenz**			**Selbständigkeit**		
		Instrumentelle Fertigkeiten	**systemische Fertigkeiten**	**Beurteilungsfähigkeit**	**Team-/Führungsfähigkeit**	**Mitgestaltung**	**Kommunikation**	**Eigenständigkeit/ Verantwortung**	**Reflexivität**	**Lernkompetenz**
Building Information Management	7	7					7		7	
Business Development and Project Management	7		7				7	7		
Data Management und Digital Transition	7			7	7					
Hygienic Processing	7			7						
Innovation Management and Consumer Centricity (WPM)	7		7	7	7		7	7	7	
Packaging Materials and Processes (WPM)	7		7				7			7
Supply Engineering	7		7		7					
Case Study	7	7	7				7	7		
Food Service Design and Management (WPM)	7		7				7	7		
Life Science Logistics	7		7				7	7		
Planning of Research Proposals and Scientific Writing (WPM)	7		7			7		7		
Production Processes and Advanced Technologies	7		7					7		
Production Site Planning	7		7				7			
Standardization and Regulation in Life Science Industry (WPM)	7		7	7		7			7	
Sustainability	7		7		7			7		
Related Degree Programmes (WPM)	(7)	(7)	(7)	(7)	(7)	(7)	(7)	(7)	(7)	(7)
Master’s Thesis	7		7				7	7		

Qualifikationsziel-Modul-Matrix

Studiengang: Life Science Engineering
StuPO-Version: 24.1

Modulbezeichnung	QZ1	QZ2	QZ3	QZ4	QZ5
Building Information Management	2	2	1	0	2
Business Development and Project Management	1	0	1	2	2
Data Management and Digital Transition	1	2	2	1	1
Hygienic Processing	2	1	1	2	1
Innovation Management and Consumer Centricity (WPM)	1	2	2	2	1
Packaging Materials and Processes (WPM)	2	1	2	1	2
Supply Engineering	2	2	2	1	2
Case Study	2	2	2	2	2
Food Service Design and Management (WPM)	2	2	2	1	2
Life Science Logistics	2	2	1	1	1
Planning of Research Proposals and Scientific Writing (WPM)	1	0	0	2	2
Production Processes and Advanced Technologies	2	1	1	2	1
Production Site Planning	2	2	2	1	1
Standardization and Regulation in Life Sciences (WPM)	1	0	1	2	2
Sustainability	2	2	0	2	2
Related Degree Programmes (WPM)	0-2	0-2	0-2	0-2	0-2
Master's Thesis	2	2	2	1	2

Unterstützung der Qualifikationsziele in den Modulen:
0=keine Unterstützung, 1=indirekte Unterstützung, 2=direkte Unterstützung

Qualifikationsziel 1:
Die Absolventinnen und Absolventen des Studiengangs Life Science Engineering verfügen über ein umfassendes, detailliertes und spezialisiertes Wissen über Planungsprozesse, Betriebsabläufe und LEAN-Prinzipien in der Life-Science-Industrie oder in Großküchen (je nach individueller Profilbildung). Sie kennen das Potential von ‚Industrie 4.0' und erwerben vertiefte Kenntnisse in den Bereichen Digitalisierung, Energie und Umwelt. Sie sind in der Lage den Begriff Nachhaltigkeit einzuordnen und können relevante Nachhaltigkeitsbezogene Informationen in ihrem Handlungsfeld in der Life-Science Industrie bewerten und daraus Optimierungspotenziale, insbesondere auch im Bereich der Ressourcen- und Energieeffizienz ableiten.

Qualifikationsziel 2:
Die Absolventinnen und Absolventen des Studiengangs Life Science Engineering haben konzeptionelle Fertigkeiten zur Planung von Einrichtungen und Gebäuden im Bereich der Life-Science-Industrie oder von Großküchen.

Qualifikationsziel 3:
Die Absolventinnen und Absolventen des Studiengangs Life Science Engineering sind in der Lage, bei der Planung und Auslegung industrieller Anlagen in der Life Science Industrie, bei der Großküchenplanung und bei der Produkt- und Verfahrensentwicklung alternative Lösungen zu entwickeln und für diese Beurteilungsmaßstäbe aufzustellen. Dabei wenden sie u.a. LEAN-Methoden wie Wertstromanalyse, Engpasstheorie, KANBAN oder Six Sigma an.

Qualifikationsziel 4:
Die Absolventinnen und Absolventen des Studiengangs Life Science Engineering verfügen über Wissen, Fertigkeiten und Kompetenzen, in einer Leitungsfunktion komplexe Aufgabenstellungen im Team zu bearbeiten, die Teammitglieder zu fördern, die Arbeitsergebnisse zu präsentieren und fachspezifische sowie übergreifende Diskussionen zu führen.

Qualifikationsziel 5:
Die Absolventinnen und Absolventen des Studiengangs Life Science Engineering sind in der Lage, eigenständig Wissen für anwendungs- und forschungsorientierte Aufgabenstellungen zu entwickeln, Zielstellungen für die Umsetzung zu erarbeiten und neben ökonomischen Aspekten auch ethische und ökologische Konsequenzen zu berücksichtigen.