

Annex 2: Module description for the English-language consecutive study program Advanced Manufacturing with the degree Master of Science

Core module Advanced Manufacturing

Module number	220000-614 (Version 01)
Module name	Mathematics for Engineering Science
Module responsibility	Dean of Studies for all study programs of the Faculty of Mathematics (except the study programs- Data Science, MINT, Advanced and Computational Mathematics)
Content and qualification goals	<p><u>Contents:</u> The module focuses on the following topics:</p> <ul style="list-style-type: none"> • Linear algebra (linear mappings, systems of equations, eigenvalues) • Power series, Taylor series and Fourier series • Differential and integral calculus (one- and multidimensional) • Ordinary differential equations <p><u>Qualification goals:</u> The goal of the module is to achieve a uniform level of practically applicable knowledge of mathematics. This requires an understanding of terms, structures and methods. Students are put in a position to do so, to translate engineering science questions into mathematical language and to solve them. The qualification goal of the internship is the acquisition of methods and procedures for the independent application of mathematical concepts and methods.</p>
Teaching forms	<p>Lectures (V), exercises(E) and practical courses(P) are the teaching forms of the module</p> <ul style="list-style-type: none"> • V: Mathematics for Engineering Science (2 LVS) • E: Mathematics for Engineering Science (1 LVS) • P: Mathematics for Engineering Science (1 LVS) <p>The teaching events will be held in the English language.</p>
Prerequisites for participation (recommended knowledge and skills)	None
Applicability of the module	---
Requirements for the award of credit points	<p>The fulfillment of the admission requirements for the examination performance and the successful completion of the module examination are requirements for the award of credit points.</p> <p>Admission requirement is the following preliminary examination (can be repeated indefinitely):</p> <ul style="list-style-type: none"> • Processing of 5 task complexes for the practical course Mathematics for Engineering Science, which must be passed individually. Passed means that at least 50% of the evaluation points have been achieved. <p>The preliminary exam must be taken in the English language.</p>
Module examination	<p>The module examination consists of an examination performance:</p> <ul style="list-style-type: none"> • 120-minute exam on Mathematics for Engineering Science (exam number: 20096) <p>The examination must be taken in the English language.</p>
Credit points and grades	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations</p>
Frequency of module	The module is offered every academic year in the winter semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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Core module Advanced Manufacturing

Module number	231533-019 (Version 03)
Module name	Digital Manufacturing
Responsible for the module	Professorship Production Systems and Processes
Contents and qualification objectives	<p><u>Content:</u> Modern industrial production is characterized by the intensive use of information and communication technology. The basis for this are intelligent and digitally connected systems. The module covers the basic knowledge of a digitalized and connected production in the value-added chain and illustrates corresponding fields of application. Students will learn the essential basic components of digital production and how these are used in the context of Industry 4.0. This includes the machine (basics of NC/CNC as well as CAD/CNC process chain, design of a machine tool, control types, MDE and DNC systems), the use of virtual and augmented reality in development and production up to models and methods of the digital factory. The theoretical knowledge is complemented by practical seminars in the individual areas. A supporting insight into the practical application of digital and connected production is provided by excursions to innovative industrial companies.</p> <p><u>Qualification Goals:</u> After successfully completing the module, students are able to</p> <ul style="list-style-type: none"> • describe the operation of an NC axis and the reference points in the working space of a machine tool, to create NC programs for geometrically simple parts manually and to explain CAD/CAM(NC) process chains of practical relevance. • prepare CAD models for use in the Virtual and Augmented Reality applications and deriving corresponding scenarios • differentiate methods and aspects of the digital factory. • analyze an existing production facility and identify potentials for the use of digitalization methods.
Teaching formats	<p>The Module contains lectures (L) and seminars (S).</p> <ul style="list-style-type: none"> • L: Digital Manufacturing (2 LVS) • S: Digital Manufacturing (2 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	<ul style="list-style-type: none"> • Basic knowledge of machine tools • Basic knowledge of CAD tools • Basic programming knowledge (C#)
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the awarding of credit points
Module examination	<p>The module examination consists of:</p> <ul style="list-style-type: none"> • 120-minute written examination (number 33640) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations</p>
Frequency	The module is offered every academic year in the winter semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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Core module Advanced Manufacturing

Module number	231631-001 (Version 03)
Module name	Additive Manufacturing
Responsible for the module	Professorship of Print Media Technology
Contents and qualification objectives	<p><u>Contents:</u> The module gives an overview of the technologies of additive manufacturing. The lectures include: Systematics and overview of subtractive and additive processes, coating and structuring, layer formation, 2D / 3D, process chains, functionalization, materials and requirements, comparison of different processes, applications.</p> <p>The Additive Manufacturing I lecture focuses on liquid-based processes and the Additive Manufacturing II lecture focuses on solid-based processes. The seminar includes patent research on specified issues in the field of additive manufacturing. After instruction and introduction to the patent databases and search strategies, each student receives a topic for independent patent research.</p> <p><u>Qualification objectives:</u> The student has a deep understanding of the systematics, function and application scenarios of modern and current technologies in the field of additive manufacturing. He should be empowered to penetrate the field of engineering science.</p>
Teaching formats	<p>The teaching format are lectures (V), lab courses (P) and seminar (S)</p> <ul style="list-style-type: none"> • V: Additive Manufacturing I (2 LVS) • V: Additive Manufacturing II (1 LVS) • S: Additive Manufacturing (1 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	<ul style="list-style-type: none"> • The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of:</p> <ul style="list-style-type: none"> • 30 minutes oral examination on Additive Manufacturing (Examination number: 31337). <p>The examination must be taken in the English language</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the winter semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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Core module Advanced Manufacturing

Module number	261033-310 (Version 01)
Module name	Resource Efficiency from an Economic Perspective
Responsible for the module	Chair of Management Accounting and Control
Contents and qualification objectives	<p><u>Contents:</u> Firstly, the course provides an overview of the integration of resources and resource efficiency in management theory. Thereafter, basing on the discipline-specific terms of resources and efficiency, methods of management accounting are presented which enable the determination and analysis of resource demand and, thus, also support the evaluation and controlling of resource efficiency. Specific topics are, among others:</p> <ul style="list-style-type: none"> • Resources and resource efficiency in management theory • Production and cost theory • Cost accounting • Investment appraisal • Selected approaches of cost management <p><u>Qualification objectives:</u> The students of the module acquire knowledge of the business perspective on resources and resource efficiency, and production and cost theory, including production functions. They will be able to apply and assess selected methods of cost accounting and cost management as well as investment appraisal.</p>
Teaching formats	<p>The teaching forms of the module are lecture and exercise.</p> <ul style="list-style-type: none"> • V: Resource Efficiency from an Economic Perspective (2 LVS) • Ü: Resource Efficiency from an Economic Perspective (1 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of: 90 minutes written examination about printing and processes I (Examination number: 61424) The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module. The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the winter semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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Core module Advanced Manufacturing

Module number	231035-004 (Version 02)
Module name	Research Methods
Responsible for the module	Professorship Sports Equipment and Technology
Contents and qualification objectives	<p><u>Contents:</u> The module conveys the basic principles of scientific work in the field of Engineering Sciences. Handling of literature sources, collection and analysis of experimental data as well as guidelines for the publication of scientific findings (articles, posters, theses, presentations) will be taught. The art of publishing scientific findings through specialist conferences is learnt using practical examples (writing short articles, active participation in a peer review process, giving a conference presentation).</p> <p><u>Qualification objectives:</u> After successfully completing the module, students are familiar with the principles of scientific work (including the basics of scientific theory, scientific ethics) and are able to apply these to their own scientific work. They can independently define the topic for a scientific abstract (conference contribution) and to delimit and structure the content. Students can research the current state of knowledge in a professional manner, present it in a thematically appropriate manner and clearly differentiate it from their own work. They can present their own research content in an appropriately condensed form. Furthermore, after successfully completing the module, students can critically reflect on their own research work and present it in the form of a short, specialised lecture (presentation). Finally, graduates will be able to objectively evaluate and appropriately recognise the work of other scientists and identify and communicate points of criticism (peer review).</p>
Teaching formats	<p>The module's type of course is the seminar.</p> <ul style="list-style-type: none"> • S: Research Methods (2 LVS)
Requirements for participation (recommended knowledge and skills)	None
Applicability of the module	---
Requirements for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of: Recognisable academic achievement:</p> <ul style="list-style-type: none"> • Semester-spanning documentation and presentation on the Advanced Manufacturing Student Conference simulation game as part of the Research Methods seminar, consisting of a scientific abstract (length: 4 pages, completion time: 8 weeks), a written peer review (length: 1 page, completion time: 2 weeks) and a 10-minute presentation (examination number: 32825). <p>The coursework is recognised if the grade of the coursework is at least 'sufficient'.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module will be offered in the winter semester of every academic year.

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Workload	The module comprises a student's workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends over one semester.

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Specialisation module Hybrid Technologies, specialisation module electives/ Soft skills

Module number	231036-004 (Version 02)
Module name	Textile Process Chains
Responsible for the module	Professorship of Textile Technologies
Contents and qualification objectives	<p><u>Contents:</u> The module teaches the basics of the processes for the production of textile reinforcement structures for high-performance fibre-plastic composites. The focus is on the different textile thread and surface manufacturing processes and their individual potentials for the variation/adjustment of composite properties. The conceptual and physical principles of thread formation from filament and staple fibers are taught and the relationships between fiber parameters, spinnability and properties of the produced thread materials are explained. The further processing of the thread materials into textile surfaces is carried out in the form of woven fabrics, braids, knitted fabrics and nonwovens. The technological principles of these manufacturing processes and the physical requirements for processing the high-performance yarn materials are presented and, based on this, the differences between the various processes with regard to the resulting material properties are worked out. Thus, the prerequisites for the understanding of process- or process parameter-specific effects on thread, surface and especially the resulting composite properties are created.</p> <p><u>Qualification objectives:</u> The students has basic knowledge of thread production and the most common surface formation processes. Due to their knowledge of the physical and technological principles of textiles, they will be able to assess the effects of modifications to textile materials and processes on the resulting composite properties.</p>
Teaching formats	<p>Teaching forms of the module are lecture and practical training.</p> <ul style="list-style-type: none"> • V: Textile Process Chains (2 LVS) • P: Textile Process Chains (1 LVS) <p>The teaching events will be held in the English language.</p>
Requirements for participation (recommended knowledge and skills)	None
Applicability of the module	---
Requirements for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points
Module examination	<p>The module examination consists of an examination paper:</p> <ul style="list-style-type: none"> • 90-minute written examination on Textile Process Chains (examination number: 34004)) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module will be offered in the summer semester of every other academic year.
Workload	The module comprises a student´s workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends over one semester.

Annex 2: Module description for the English-language consecutive study program Advanced Manufacturing with the degree Master of Science

Specialisation module Hybrid Technologies, specialisation module electives/ Soft skills

Module number	231133-013 (Version 01)
Module name	Recycling of Plastics
Responsible for the module	Professorship of Textile Technologies
Contents and qualification objectives	<p><u>Contents:</u> The module provides basic knowledge of the structure, composition and behaviour of plastics, including fibres and composites, which are relevant to recycling issues. In addition to an overview of the product forms, their composition and processing methods of plastics technology, the recycling concepts of product recycling, material recycling and raw material recycling and their application limits of plastics, plastic-containing composites and composite materials as well as their thermal utilisation are dealt with, with the aim of linking material, technical and economic aspects. In addition, there is an overview of product life cycles with the aim of closed cycles and an introduction to recycling-orientated product design. The lecture also includes alternative material concepts, a comparison with classic technologies in the packaging sector and biomaterials (biopolymers, compostable plastics, natural fibre-reinforced plastics).</p> <p>There will also be practical exercises on selected technologies, such as plastic identification and sorting, shredding, compounding and primary moulding, as well as testing of independently produced test specimens made from recyclates.</p> <p><u>Qualification objectives:</u> After successfully completing the module, students will be able to apply the knowledge they have acquired about the basic structure and composition of plastic products in order to implement them in a recycling-friendly design. Students will be able to develop a recycling-friendly design for plastic products and provide advice on recycling issues during product development. They will be able to evaluate recycling strategies and the use of alternative materials from an economic point of view.</p>
Teaching formats	<p>Teaching forms of the module are lecture and practical training.</p> <ul style="list-style-type: none"> • V: Recycling of Plastics (2 LVS) • P: Recycling of Plastics (1 LVS) <p>The teaching events will be held in the English language.</p>
Requirements for participation (recommended knowledge and skills)	None
Applicability of the module	---
Requirements for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of an examination paper:</p> <ul style="list-style-type: none"> • 90-minute written examination on Recycling of Plastics (examination number: 32119)) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module will be offered in the summer semester of every academic year.
Workload	The module comprises a student's workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends over one semester.

Annex 2: Module description for the English-language consecutive study program Advanced Manufacturing with the degree Master of Science

Specialisation module Hybrid Technologies, specialisation module electives/ Soft skills

Module number	231431-012 (Version 05)
Module name	Applied Modelling and Simulation in Solid Mechanics I
Responsible for the module	Professorship of Solid Mechanics
Contents and qualification objectives	<p><u>Contents:</u> The module first covers the fundamentals of linear continuum mechanics and material modeling. This is followed by an introduction to the linear finite element method, with the emphasis on the application of commercial FEM programs.</p> <ul style="list-style-type: none"> • Representation and calculation rules of tensors • Invariants, Eigenvalues and Eigenvectors • Distortion and voltage tensors • Rheological substitute models, elasticity, viscoelasticity • Solution algorithm of linear FEM • Element types and numerical integration <p><u>Qualification objectives:</u> After successful completion of the module, students are able to calculate problems in linear solid-state mechanics and thus perform the tasks of a development and calculation engineer in the field of computer-aided component simulation.</p>
Teaching formats	<p>Teaching forms of the module are lecture and exercise.</p> <ul style="list-style-type: none"> • V: Applied Modelling and Simulation in Solid Mechanics I (2 LVS) • Ü: Applied Modelling and Simulation in Solid Mechanics I (2 LVS) <p>The teaching events will be held in the English language.</p>
Requirements for participation (recommended knowledge and skills)	At least two semester lecture on technical mechanics
Applicability of the module	---
Requirements for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of an examination paper:</p> <ul style="list-style-type: none"> • 30-minute oral exam on Applied Modelling and Simulation in Solid Mechanics I (examination number: 31819) <p>The exam can be taken in German or English.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module will be offered in the summer semester of every academic year.
Workload	The module comprises a student's workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends over one semester.

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Specialisation module Hybrid Technologies, specialisation module electives/ Soft skills

Module number	231833-007 (Version 05)
Module name	Surface and Interface Engineering
Responsible for the module	Professorship Materials and Surface Engineering
Contents and qualification objectives	<p><u>Contents:</u> The module includes the topics surface and coating technology as well as the interface design in hybrid material compounds. Thereby, emphasis is put on the comprehension of the relations between process, (micro)structure and properties.</p> <p>Knowledge is provided about all major processes for the production of metallic, inorganic-nonmetallic and organic coatings and surface structures.</p> <p>Under consideration of the complex requirement profile of surfaces and interfaces due to mechanical, tribological, corrosive and thermal loads, design strategies to meet these requirements are presented.</p> <p><u>Qualification objectives:</u> The students know the chemical, physical and technological fundamentals of the essential processes of surface or coating technology including important pre- and post-treatment processes. They recognize and understand the fundamental relationships between the process characteristics and the resulting structures and properties of the coatings. They are able to select coating systems based on the application and to justify their selection in a well-founded manner.</p>
Teaching formats	<p>Teaching formats of the module are Lecture (V), Seminar (S) and Practical Course (P)</p> <ul style="list-style-type: none"> • V: Surface and Interface Engineering (2 LVS) • S: Surface and Interface Engineering (2 LVS) • P: Surface and Interface Engineering (1 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	Basic knowledge about chemical bonds, atomic structure, periodic table of elements, structure of crystalline materials, corrosion and wear
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of:</p> <ul style="list-style-type: none"> • 90-minute written exam on Surface and Interface Engineering (examination number: 32510) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the summer semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Hybrid Technologies, specialisation module electives/ Soft skills

Module number	231032-018 (Version 04)
Module name	Calculation of Anisotropic Composite Materials
Responsible for the module	Professorship of Lightweight Structures/Polymer Technology
Contents and qualification objectives	<p><u>Contents:</u> In this module, the basics of elasticity theory for anisotropic material behavior of the single layer will be taught in order to derive the multilayer theory. Multilayer composites of fiber-reinforced materials represent future-oriented lightweight construction solutions, especially in the aerospace, innovative vehicle construction and general mechanical engineering. Using classical laminate theory as a mathematical tool, students will learn to understand the complex stress and deformation behavior of flat surface structures made of fiber-reinforced plastics (FRP) as a result of mechanical, thermal and media-related loads. In addition, general and fracture mode-related failure hypotheses will be taught, which are applied in different design concepts.</p> <p><u>Qualification objectives:</u> After successful completion of the module, students are able to calculate components and structures made of a material with anisotropic material behavior. This enables them to determine a structural behavior for multi-layer composites that is suitable for loading by means of targeted layer orientation and targeted layer build-up.</p>
Teaching formats	<p>Teaching formats of the module are lecture and seminar.</p> <ul style="list-style-type: none"> • V: Calculation of Anisotropic Composite Materials (2 LVS) • S: Calculation of Anisotropic Composite Materials (1 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	Basics of mathematics, physics and technical mechanics
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of:</p> <ul style="list-style-type: none"> • 90-minute exam on Calculation of Anisotropic Composite Materials (examination number: 33147) <p>The teaching events will be held in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the winter semester.
Workload	The module comprises a student workload of 150 WH (working hours).
Duration of the module	In a regular course of study, the module extends over one semester.

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Specialisation module Hybrid Technologies, specialisation module electives/ Soft skills

Module number	231032-020 (Version 02)
Module name	Polymer-based Hybrid Structures
Responsible for the module	Professorship Lightweight Structures/Polymer Design
Contents and qualification objectives	<p><u>Contents:</u> This module teaches the basics of bio-based plastics from the raw material basis and synthesis, processing to their properties and applications. In addition, the knowledge transfer on bio-based composites is based on the extraction of natural fibers and their properties as well as natural fiber semi-finished products and compounds, their processing into composite components up to their disposal and recycling. In addition, students will be taught the basics for the design of the fiber-matrix interface, which are decisive for the quality and properties of fiber-plastic composites. The module offers an overview of the physical and chemical properties of textile surfaces or matrix interfaces, the possibilities of targeted activation, functionalization and modification of the outer material layers as well as material combinations and their compatibility. Practical courses on the processing of bio-based plastics and composites and on the exemplary determination of physical and chemical surface properties complete the curriculum.</p> <p><u>Qualification objectives:</u> Students will be able to reproduce basic knowledge about the structure and processing of bioplastics and bio-composites as well as their resource efficiency and sustainability and classify them correctly in terms of their application. Students are also able to select measures to improve adhesion through to targeted boundary layer design for fibre-reinforced plastic composites in order to specifically influence fibre-matrix adhesion.</p>
Teaching formats	<p>Teaching formats of the module are lecture and seminar.</p> <ul style="list-style-type: none"> • V: Polymer-based Hybrid Structures (2 LVS) • S: Polymer-based Hybrid Structures (1 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of:</p> <ul style="list-style-type: none"> • 90-minute exam on Polymer-based Hybrid Structures (examination number: 33146) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the winter semester.
Workload	The module comprises a student workload of 150 WH (working hours).
Duration of the module	In a regular course of study, the module extends over one semester.

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**Specialisation module Hybrid Technologies and Smart Production, specialisation module electives/
Soft skills**

Module number	231831-012 (Version 04)
Module name	Complex Materials for Manufacturing
Responsible for the module	Professorship of Composites and Material Compounds
Contents and qualification objectives	<p><u>Contents:</u> The increasing complexity of product requirements increasingly calls for the use of modern material solutions. In addition to ceramic and metallic construction materials, composite materials and material composites are becoming increasingly important. As a single material often does not fully meet the required property profile, the development of suitable material combinations and the development of new manufacturing technologies are essential. Complex designed material systems occupy a key position and are of fundamental importance on the growth markets. Tailor-made materials for lightweight construction and high-temperature applications are in demand. To this end, new joining and composite concepts must be developed for a wide variety of material groups. This requires material-specific knowledge and correlation skills as well as the design of manufacturing technologies.</p> <p>In the module, the development and use of metallic, ceramic and glass-like lightweight, high-temperature and composite materials are discussed in particular and the importance of these material groups for the production of customized material solutions is elaborated. Students will first receive an overview of the definitions of terms. Materials science fundamentals with reference to the materials under consideration are explained, and the properties and application potential are discussed. Various reinforcement concepts for composite materials based on fibres and particles are presented and discussed in depth. Aspects of material digitalization and simulation are taught using the example of ceramic matrix composites. Furthermore, the suitable combination of materials to form material composites by means of innovative manufacturing processes is dealt with. In the practical course, students gain an insight into the manufacture and characterization of ceramic and metal-based composites.</p> <p><u>Qualification objectives:</u> Students will be able to confidently use the terms metal, ceramic, glass, composite and material composite, explain common manufacturing processes and characterize the properties. In addition, students have demonstrated the necessary expertise to confidently assess the application potential of metallic, ceramic and glass-like lightweight materials and their composite solutions. They will be able to identify challenges in joining dissimilar materials and propose appropriate joining solutions. Likewise, students are able to evaluate and apply manufacturing and testing methods with regard to the opportunities and limitations of these material groups.</p>
Teaching formats	<p>Learning methods of the module are Lecture (L) and Internship (I).</p> <ul style="list-style-type: none"> • L: Complex Materials for Manufacturing (2 LVS) • I: Complex Materials for Manufacturing (1 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	Fundamentals of Materials Engineering
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.

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Module examination	The module examination consists of: <ul style="list-style-type: none">• 120-minute exam on Complex Materials for Manufacturing (examination number: 33319) The examination language is English. On request, in exceptional cases, the examination performance can be provided in German.
Credit points and marks	5 credit points are awarded within the module. The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.
Frequency	The module is offered every academic year in the winter semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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**Specialisation module Hybrid Technologies and Smart Production, specialisation module electives/
Soft skills**

Module number	231032-019 (Version 03)
Module name	Composite-based Hybrid Technologies
Responsible for the module	Professorship Lightweight Structures/Polymer Design
Contents and qualification objectives	<p><u>Contents:</u> Cost-efficient large-scale technologies for the production of hybrid composite components are crucial for the industrial use of lightweight materials. In the lectures of the module, composite materials are classified and their structure and manufacture are explained. Knowledge of fibers, textile structures and polymer matrices, their production and use in fiber-reinforced plastics, load-appropriate and selected with regard to reinforcing effect, strength behavior and substance utilization, is acquired. Efficient technologies for the production of thermoset and thermoplastic polymer matrix composite semi-finished products and components are explained and compared. Based on this, the processing of polymer matrix composites in mixed designs and in hybrid structures is explained and characterized. When it comes to the materials and material combinations used, the circular economy is considered with a particular focus on recycling and sustainability. Numerous practical applications are demonstrated by way of example, and the fundamentals of test methods are taught and discussed. In the exercises, methods for determining material parameters are discussed and micromechanical calculations are explained. Based on this, macromechanical theories and formulas are discussed and compared. A thermoset-based textile semi-finished product is manufactured and mechanically tested, and the methods of manufacturing textile-reinforced thermoplastic components are demonstrated and explained in the laboratories.</p> <p><u>Qualification objectives:</u> The students have demonstrated a comprehensive knowledge of the design and use of hybrid composite structures, their technologies for manufacturing and processing, the resulting component properties including suitable measurement and testing methods. The students are able to apply their acquired expertise in a focused and targeted manner for the development of high-performance lightweight components.</p>
Teaching formats	<p>Teaching formats of the module are lecture and seminar.</p> <ul style="list-style-type: none"> • V: Composite-based Hybrid Technologies (2 LVS) • S: Composite-based Hybrid Technologies (1 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	<p>The successful passing of the module examination is the precondition for the award of credit points.</p> <p>The admission requirement is 2 passed tasks in the exercise Composite-based Hybrid Technologies. Passed means that for each at least 50% of the evaluation points have been achieved.</p>
Module examination	<p>The module examination consists of:</p> <ul style="list-style-type: none"> • 90-minute exam on Composite-based Hybrid Technologies (examination number: 33144) <p>The examination must be taken in the English language.</p>

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Credit points and marks	5 credit points are awarded within the module. The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.
Frequency	The module is offered every academic year in the winter semester.
Workload	The module comprises a student workload of 150 WH (working hours).
Duration of the module	In a regular course of study, the module extends over one semester.

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Specialisation module Smart Production, specialisation module electives/ Soft skills

Module number	231732-011 (Version 02)
Module name	Joining Technologies and Strategies
Responsible for the module	Professorship Welding Technology
Contents and qualification objectives	<p><u>Contents:</u> The module teaches the basics of industrially used joining techniques and their application possibilities. It deals with force-, shape- and material- locking joining technologies, material-technical aspects of joining processes as well as possibilities for the characterization of joining properties</p> <p><u>Qualification objectives:</u> Students are able to select joining techniques for various application scenarios, considering technological, material-technical and design aspects.</p>
Teaching formats	<p>Lectures and exercises are the teaching forms of the module.</p> <ul style="list-style-type: none"> • L (Lecture): Joining Technologies and Strategies (2 LVS) • E (Exercise): Joining Technologies and Strategies (1 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of an examination performance:</p> <ul style="list-style-type: none"> • 90-minute exam on Joining Technologies and Strategies (examination number: 32715) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are earned in the module.</p> <p>The assessment of the examination performance and the formation of the module grade are regulated in § 10 of the examination regulations.</p>
Frequency	The module is offered every academic year in the summer semester.
Workload	The module comprises a total workload of 150 WH for the students.
Duration of the module	If the course of studies is regular, the module lasts one semester.

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Profile modules profile areas Hybrid Technologies, Production Systems, supplementary module Elective Courses

Module number	231537-003 (Version 02)
Module name	Forming Process Chains
Responsible for the module	Professorship for Forming Technology
Contents and qualification goals	<p><u>Contents:</u> Knowledge is imparted on the design, layout and evaluation of process chains for components that can be manufactured using sheet metal and solid forming processes. In addition to the forming technology processes, upstream and downstream processes such as component heating, cutting and (inductive) joining are also considered. In addition to the forming technology and process-specific basics, knowledge of the specifics of forming tools and forming machines is imparted and the influence of important process parameters (e.g. temperature) is demonstrated. Conventional and alternative process routes are developed and evaluated in terms of component quality, flexibility and resource efficiency, taking into account the number of pieces to be produced and the use of resources.</p> <p><u>Qualification goals:</u> After completing the module, students will be able to</p> <ul style="list-style-type: none"> • describe and explain the fundamentals of forming technology and selected forming processes, • develop and design process chains for sheet metal and solid components depending on given boundary conditions and requirements (e.g. production quantity), • describe the special features of cold and hot forming when designing process chains, • identify process chain variants and evaluate them from the point of view of resource efficiency and flexibility, • derive requirements for forming tools and machines, • explain the influence of various parameters on the process window and thus on the quality of the formed part, and • explain measures for achieving process reliability
Teaching forms	<p>Teaching forms of the module are lectures (V), exercises (Ü) and practical training (P).</p> <ul style="list-style-type: none"> • V: Forming Process Chains (2 LVS) • Ü: Forming Process Chains (1 LVS) • P: Forming Process Chains (1 LVS) <p>The teaching events will be held in the English language.</p>
Requirements for participation	Knowledge of production engineering
Applicability of the module	---
Requirements for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of one examination performance:</p> <ul style="list-style-type: none"> • 120-minute written examination on Forming Process Chains (Examination number: 34101) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>In this module 5 credit points are acquired.</p> <p>The assessment of the examination performance and the formation of the module mark are regulated in § 10 of the examination regulations.</p>
Frequency of offer	The module is offered every academic year in the summer semester.
Workload	The module comprises a students' workload of 150 WH (working hours).

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Duration of the module	In the case of a regular course of study, the module extends over one semester.
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Annex 2: Module description for the English-language consecutive study program Advanced Manufacturing with the degree Master of Science

Specialisation module Smart Production, specialisation module electives/ Soft skills

Module number	231533-020 (Version 03)
Module name	Machining Technologies
Responsible for the module	Professorship Production Systems and Processes
Contents and qualification objectives	<p><u>Contents:</u> Advanced knowledge of machining is imparted. Building on the process fundamentals, special attention is paid to the design of efficient processes. Here the focus is on the target-oriented selection of the decisive system variables and the determination of the process setting variables. The tool selection and the specific determination of the cutting parameters are the focal points. The methods of CNC machining are taught on the basis of process examples in an application-oriented manner. The aim is the independent process design of turning, milling and water jet processes including implementation. Finally, the trends in machining are discussed.</p> <p><u>Qualification objectives:</u> After completion of the module the students are able to,</p> <ul style="list-style-type: none"> • select machining procedures for geometric forms, • select system variables such as tools and clamping devices in relation to the work-piece properties, • determine process parameters in a targeting manner, • create NC machining programs themselves with different methods, • optimize milling processes in terms of cost and quality criteria, • assess the current trends in machining.
Teaching formats	<p>Forms of teaching within the module are Lectures, Exercises and Practical Courses</p> <ul style="list-style-type: none"> • V: Machining Technologies (1 LVS) • Ü: Machining Technologies (1 LVS) • P: Machining Technologies (2 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	Basic knowledge of manufacturing technologies.
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of:</p> <ul style="list-style-type: none"> • 120-minute written examination on Machining Technologies (examination number: 33641) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the winter semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Smart Production, specialisation module electives/ Soft skills

Modul number	231534-007 (Version 02)
Modul name	Efficient Process Chains
Responsible for the module	Professorship Micromanufacturing Technology
Contents and qualification objectives	<p><u>Contents:</u> The module conveys fundamentals and approaches in the development of resource efficient processes and process chains. Firstly, there is a survey on methods for the structuring of manufacturing processes as well as technology and manufacturing planning. Subsequently fundamentals on cutting, abrasive and forming processes with examples from threading, hard and non-circular turning, deep hole drilling, dry machining, deburring and others are given. These manufacturing processes are then analyzed and compared regarding their efficiency in the context of the whole process chain. Furthermore, the process chains and operating materials for the manufacturing of rotationally symmetric and prismatic workpiece especially in mechanical engineering and automotive are explained and detailed based on specific examples.</p> <p><u>Qualification objectives:</u> Subsequent to the successful attendance of the module, the students are capable of ...</p> <ul style="list-style-type: none"> • explaining the necessity of efficiency improvement in process chains. • explaining the fundamental structure of process chains from raw stock to workpiece in manufacturing rotationally symmetric and prismatic workpieces by means of workflow charts. • analyzing existing process chains, identifying optimization potential and develop possible solutions for increased efficiency.
Teaching formats	<p>Form of teaching of the module are lectures, exercises and practical training.</p> <ul style="list-style-type: none"> • L: Efficient Process Chains (2 LVS) • E: Efficient Process Chains (1 LVS) • P: Efficient Process Chains (1 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	Fundamental knowledge concerning manufacturing processes and technologies.
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module exam consists of one test achievement.</p> <ul style="list-style-type: none"> • 120-minute written exam on efficient process chains (examination number: 32419) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>In the module 5 credit points can be achieved.</p> <p>The evaluation of the exam performance and the valuation of the module grade are regulated according to § 10 of the examination regulations.</p>
Frequency	The module is provided in each study year in winter semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In case of regular study progress the duration of the module is one semester.

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Specialisation module Smart Production, specialisation module electives/ Soft skills

Module number	231539-006 (Version 02)
Module name	Geometrical Product Specification and Verification
Responsible for the module	Professorship of Production Measurement Technology
Contents and qualification objectives	<p><u>Contents:</u> Geometrical specification is the basis for the development of products, correct simulation analysis, manufacturing, measurement and more. The module presents an overview of the concept of the international Geometrical Product Specification and Verification (GPS) system. The nonverbal communication method introduces symbols and rules to describe geometrical properties complete and unambiguous. Verification methods are presented for measuring deviations on real parts to collect data in correlation to functional and process parameters. Decision rules provide the students with knowledge on the selection of the measuring methods and strategies. Exercises and practical trainings are added to learn how to use the GPS system for the specification, work with measurement instruments and correlate measurement results with the specification.</p> <p><u>Qualification objectives:</u> At the end of the module, the students understand the basic concepts of the GPS-system. Theoretical and practical knowledge is available for solving fundamental specification and verification tasks. They are especially qualified to specify geometrical properties according to functional properties as basis for the derivation of manufacturing technologies. Besides that, they can select measurement instruments for different geometrical measurements and understand measurement results to correlate with specification.</p>
Teaching formats	<p>The module consists of lecture, exercises and practical training</p> <ul style="list-style-type: none"> • L: Geometrical Product Specification and Verification (2 LVS) • E: Geometrical Product Specification and Verification (1LVS) • P: Geometrical Product Specification and Verification (1 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	Basic knowledge in design and manufacturing technologies.
Applicability of the module	--
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of 30-minute oral exam on the topic of Geometrical Product Specification and Verification (examination number: 31719)</p> <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the summer semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Smart Production, specialisation module electives/ Soft skills

Module number	231533-021 (Version 03)
Module name	Design and Control of Smart Production Systems
Responsible for the module	Professorship Production Systems and Processes Professorship for Adaptronics and Lightweight Design (in Production)
Contents and qualification objectives	<p><u>Contents:</u> The fundamentals, procedures and methods for the development, monitoring and control of modern mechatronic production systems are taught. Based on a detailed description, modeling and simulation of central components, tools for the evaluation and development of production systems are addressed. The acquisition of information, its conversion, forwarding and processing in the context of the Internet of Things is dealt with in depth. Furthermore, the expansion of process boundaries through the integration of actuator and sensor functionality close to the point of action is dealt with. Automation, as an essential link, complements the course with the aspects of planning, control and monitoring of movements in production systems. This includes an overview of systematic design methods as well as the structure, mode of operation, programming and operation of current control systems.</p> <p><u>Qualification objectives:</u></p> <ul style="list-style-type: none"> • to recognize and evaluate interdisciplinary relationships in the mechatronic system of machine tools, • to describe individual components of machine tools and multi-machine systems, • to implement the possibility of data acquisition and analysis according to the situation, • apply experimental and simulative methods to identify mechanical and control parameters, and • design the control system for typical drive solutions in mechanical engineering.
Teaching formats	<p>Forms of teaching within the module are Lectures, Exercises and Practical Courses</p> <ul style="list-style-type: none"> • V: Design and Control of Smart Production Systems (2 LVS) • Ü: Design and Control of Smart Production Systems (1 LVS) • P: Design and Control of Smart Production Systems (1 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	Basic knowledge of mechanics, machine elements, electrical engineering
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of:</p> <ul style="list-style-type: none"> • 120-minute written examination on Design and Control of Smart Production Systems (examination number: 33642) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the summer semester.

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Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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**Specialisation module Work Design and Sustainability Management, specialisation module electives/
Soft skills**

Module number	231232-015 (Version 01)
Module name	Sustainable Smart Manufacturing
Responsible for the module	Professorship Factory Planning and Intralogistics
Contents and qualification objectives	<p><u>Contents:</u></p> <ul style="list-style-type: none"> • Organisation of the production system: systematics in industrial production (types of products, types of companies, industries), system-theoretical foundations for the description of factories, organisation of the production system • Planning of production systems: Procedure for planning production systems, factory/production networks, material flow/logistics • Operation in the production system: planning/work preparation, lean production, maintenance, sustainability and operational management systems • Trends in industry and their potential applications (e.g. Industry 4.0, artificial intelligence, resource efficiency) <p><u>Qualification objectives:</u> After completing the module, students will be able to describe and reflect on the structure and functions of a production plant from a technical and organisational perspective. They will be able to establish connections between various disciplines involved in the planning and operation of production systems. They have a holistic understanding of factory/production systems and the interaction between people, technology and organisation. They will be able to design selected aspects of the organisation of production systems using examples. They have a basic understanding of the structure and functioning of management systems (quality and environmental management) and know how these are evaluated. They have a basic understanding of current trends in the organisation of production systems and their potential applications. Students are familiar with methods for organising and planning production operations.</p>
Teaching formats	<p>The teaching formats of the module are: Lectures(L) and Exercise (E)</p> <ul style="list-style-type: none"> • L: Sustainable Smart Manufacturing (2LVS) • E: Sustainable Smart Manufacturing (2 LVS) <p>The teaching events will be held in the English language.</p>
Requirements for participation (recommended knowledge and skills)	None
Applicability of the module	---
Requirements for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of:</p> <ul style="list-style-type: none"> • 120-minute written exam on Sustainable Smart Manufacturing: Challenges for Political Processes (examination number: 31519). <p>The examination must be taken in the English language.</p>

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Credit points and marks	5 credit points are awarded within the module. The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.
Frequency	The module is offered every academic year in the summer semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends over one semester.

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**Specialisation module Work Design and Sustainability Management, specialisation module electives/
Soft skills**

Module number	261033-311 (Version 01)
Module name	Life Cycle Engineering
Responsible for the module	Chair of Management Accounting and Control
Contents and qualification objectives	<p><u>Contents:</u> The module provides an overview of the basic ideas and the theoretical background of Life Cycle Engineering (LCE) as well as deeper insights in specific approaches and modeling techniques. Specific topics are (among others):</p> <ul style="list-style-type: none"> • product life cycle models • evaluation of technical, economic and ecological performances • multi-dimensional performance models • material and technology selection • case studies <p><u>Qualification objectives:</u> On successful completion of the module, students will have developed or sharpened their understanding of the need to incorporate technical, economic and ecological objectives into decisions, particularly in the early phases of the product life cycle. A particular focus is also placed on the necessary (evaluation) approaches and models, which the students will have deepened and finally be able to apply in practice as part of a case study to be worked on in small groups.</p>
Teaching formats	<p>The teaching forms of the module are lecture and case study.</p> <ul style="list-style-type: none"> • L: Life Cycle Engineering (2 LVS) • CS: Life Cycle Engineering (1 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of 2 examinations:</p> <ul style="list-style-type: none"> • 10- minute presentation of the Case study of Life Cycle Engineering (examination number: 61428) • 60-minute written exam on Life Cycle Engineering (examination number 61421) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p> <p>Examinations:</p> <ul style="list-style-type: none"> • Presentation of the case study on Life Cycle Engineering, Weight 3, Passing required • Examination on Life Cycle Engineering, Weight 7, Passing required
Frequency	The module is usually offered every academic year in the summer semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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**Specialisation module Work Design and Sustainability Management, specialisation module electives/
Soft skills**

Module number	261033-312 (Version 01)
Module name	Life Cycle-oriented Management
Responsible for the module	Chair of Management Accounting and Control
Contents and qualification objectives	<p><u>Contents:</u> The module first provides an overview of life cycle models and concepts. Subsequently, life cycle-related design tasks to be assigned to the strategic management level and the instruments that can be used for these are presented. One focus is on selected life cycle-related decision-making models and methods such as:</p> <ul style="list-style-type: none"> • Life Cycle Costing/Total Cost of Ownership <ul style="list-style-type: none"> • Dynamic investment appraisal for profitability, useful life and replacement decisions • Approaches for the inclusion of taxes • Flow cost accounting <ul style="list-style-type: none"> • Key figures and key figure systems • Value stream design • Business model development <p><u>Qualification objectives:</u> Students of the module should be familiar with life cycle-related decisions from a business perspective, be able to explain them and have also learnt and acquired specific knowledge, particularly with regard to corresponding methods for preparing decisions.</p>
Teaching formats	<p>The teaching forms of the module are lecture and exercise.</p> <ul style="list-style-type: none"> • V: Life Cycle-oriented Management (2 LVS) • Ü: Life Cycle-oriented Management (1 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of: 90-minute written exam on Life Cycle-oriented Management (number 61420) The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module. The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is usually offered every academic year in the summer semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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**Specialisation module Work Design and Sustainability Management, specialisation module electives/
Soft skills**

Module number	261042-301 (Version 01)
Module name	Sustainability Management
Responsible for the module	Professorship for Corporate Environmental Management and Sustainability
Contents and qualification objectives	<p><u>Contents:</u> Integrative management skills are essential for today's entrepreneurial and operational activities and decision-making. The integration of sustainability aspects is not so much an add-on as a different perspective and a systemic conceptualisation of management activities. The module covers all key corporate functions, such as sustainable procurement, production, logistics, supply chain management, organisation, marketing, etc. In addition, key instruments and standards are presented. In addition to theoretical and conceptual work, various examples from different industries are discussed and analysed.</p> <ul style="list-style-type: none"> • Sustainability –necessity, concepts and models • Sustainability management and its anchoring in (existing) operational management systems <p><u>Qualification objectives:</u> After successfully completing the module, students will be able to</p> <ul style="list-style-type: none"> • identify participants, problems and interrelationships of the functional areas in their sustainability activities (knowledge), • explain interactions and systemic processes in sustainability management (understanding), • assess concepts of sustainability in different contexts (apply), • determine sustainability instruments and the limits of sustainability innovations in holistic value chains (analyse), • assess the prerequisites and conditions of sustainability-oriented strategies, innovations and instruments (assess).
Teaching formats	<p>The module's types of courses are lecture and practical courses.</p> <ul style="list-style-type: none"> • V: Sustainability Management (2 LVS) • Ü: Sustainability Management (1 LVS) <p>The teaching events will be held in the English language.</p>
Requirements for participation (recommended knowledge and skills)	Read the recommended literature list of the course (chair website, learning platform or set of slides)
Applicability of the module	The module is suitable for all degree programmes with an economics focus and for teaching export.
Requirements for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of:</p> <ul style="list-style-type: none"> • 90-minute written exam on Sustainability Management (examination number: 62104) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module will usually be offered in the summer semester of every academic year.
Workload	The module comprises a students' workload of 150 WH (working hours).

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Duration of the module	In a regular course of studies, the module extends over one semester.
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**Specialisation module Work Design and Sustainability Management, specialisation module electives/
Soft skills**

Module number	261033-313 (Version 01)
Module name	IT-supported Evaluation of Material Flows and Process Chains
Responsible for the module	Chair of Management Accounting and Control
Contents and qualification objectives	<p><u>Contents:</u> Interdisciplinary case studies to be worked on in small groups, in which application and consolidation of the acquired knowledge regarding the evaluation of material flows and process chains takes place and the problem-related knowledge and skills as well as the use of suitable software tools are deepened independently.</p> <p><u>Qualification objectives:</u> After successfully completing the module, students will have applied their knowledge of material flow and process chain evaluation methods from the preceding basic and profile modules in the curriculum to a specific case study with IT support, thereby deepening their understanding of methods and expanding their application-oriented skills. The focus is on the application and linking of theoretical knowledge from the basic and specialisation modules that precede it in the curriculum. In addition, the joint processing of the case study and presentation of the results promote the further development of social skills as well as the presentation, discussion and moderation skills of the participants.</p>
Teaching formats	<p>The teaching form of the module is the case study.</p> <ul style="list-style-type: none"> FS: Case study of IT-supported Evaluation of Material Flows and Process Chains (2 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of two examinations. The following examinations are to be taken:</p> <ul style="list-style-type: none"> Written report of a case study on IT- supported Evaluation of Material Flows and Process Chains (length: 10-15 pages, processing time: 13 weeks) (exam number: 61422) 15-minute oral presentation of the case study on IT- supported Evaluation of Material Flows and Process Chains (examination number: 61423) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p> <p>Examinations:</p> <ul style="list-style-type: none"> Written report, on IT- supported Evaluation of Material Flows and Process Chains weighting 3 – pass required Oral presentation on IT- supported Evaluation of Material Flows and Process Chains, weighting 2 – pass required
Frequency	The module is usually offered every academic year in the winter semester.
Workload	The module comprises a students' workload of 150.WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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**Specialisation module Work Design and Sustainability Management, specialisation module electives/
Soft skills**

Module number	231035-005 (Version 02)
Module name	Instrumentation
Responsible for the module	Professorship Sports Equipment and Technology
Contents and qualification objectives	<p><u>Contents:</u> The module Instrumentation conveys the procedure and the special requirements to measure the human-environment interaction with measuring instruments. The basic approaches for the selection of suitable hardware, software and measurement methodology as well as the design and composition of corresponding measurement chains are taught for different measuring tasks.</p> <p><u>Qualification objectives:</u> After successfully completing the module, students will be able to understand and independently apply key principles for selecting sensors and data acquisition systems for measuring physical (especially mechanical) parameters in the context of 'people and production' for specific applications. The special requirements for selecting the components of the measurement chain are known and can be applied to the solution of an individual measurement task. Students are able to select suitable software for data analysis and to summarise the collected data into application-relevant information using adequate methods and to present it in a scientifically correct manner.</p>
Teaching formats	<p>The module's types of courses are lecture and practical course.</p> <ul style="list-style-type: none"> • V: Instrumentation (1 LVS) • P: Instrumentation (2 LVS) <p>The teaching events will be held in the English language.</p>
Requirements for participation (recommended knowledge and skills)	None
Applicability of the module	---
Requirements for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of:</p> <ul style="list-style-type: none"> • elaboration of a scientific poster (size: A0, processing time 4 weeks) with 30-minute defense (5-minute presentation and 25-minute discussion) on instrumentation (examination number: 32817) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the winter semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends over one semester.

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**Specialisation module Work Design and Sustainability Management, specialisation module electives/
Soft skills**

Module number	231231-008 (Version 05)
Module name	Innovation and Value Creation
Responsible for the module	Chair of Ergonomics and Innovation Management
Contents and qualification objectives	<p><u>Contents:</u> New possibilities of the Internet, social networks and the omnipresence of computers (pervasive computing) are changing innovation processes and value chains. Considering this, the course introduces the concept of interactive value creation and related approaches. Students have the opportunity to reflect and discuss the effects on the strategic and operational management of technology-oriented companies and on the work organization of the future. Focuses are on</p> <ul style="list-style-type: none"> • Innovation management processes • Collaborative innovation • Interactive added value • Open innovation <p><u>Qualification objectives:</u> Students gain knowledge on current concepts of technology-oriented innovation management and they can classify trends. They are able to deal scientifically with the fundamentals of innovation management through independent work and apply various methods of the idea generation process.</p>
Teaching formats	<p>The seminar is the teaching form of the module.</p> <ul style="list-style-type: none"> • S: Innovation and Value Creation (2 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of</p> <ul style="list-style-type: none"> • Seminar paper (size: 12-15 pages, scheduled time: 8 weeks) on Innovation and Value Creation (exam number: 31220) <p>The examination must be taken in the English language. In exceptional cases, the examination may also be taken in German upon request.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the marking are regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the winter semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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**Specialisation module Work Design and Sustainability Management, specialisation module electives/
Soft skills**

Module number	231231-009 (Version 02)
Module name	Digital Ergonomics
Responsible for the module	Chair of Ergonomics and Innovation Management
Contents and qualification objectives	<p><u>Contents:</u> In order to make work productive, healthy, motivating and beneficial, it is necessary to adapt working conditions to the physiological, psychological and cognitive requirements and abilities of man. The module introduces self-learning material on ergonomic analysis and on ergonomic work design concepts. On this basis, the course imparts expertise and methodological skills in seminars and exercises in order to apply the ergonomic concepts with the help of advanced digital tools. Focuses are on</p> <ul style="list-style-type: none"> • basic concepts of ergonomic work analysis and work design • selected methods of ergonomic work analysis and work design (e.g. in the areas of anthropometry, physical strength, posture, target times) • 3D modeling of work systems • Modeling with digital human models • Ergonomic analyzes with digital human models • Deriving ergonomic improvement measures using a case study <p><u>Qualification objectives:</u> Students can apply the principles and rules of ergonomic analysis and design of work with the help of selected digital tools. They can reflect on the potential and limits of digital ergonomics.</p>
Teaching formats	<p>The seminar and the tutorial are the teaching forms of the module.</p> <ul style="list-style-type: none"> • S: Digital Ergonomics (2 LVS) • Ü: Digital Ergonomics (2 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	The module examination consists of a semester-spanning practical work (creation of 5 digital models, processing time: 2 weeks each, total scope: 35 AS) with 20-minute final colloquium on Digital Ergonomics (examination number: 31221)

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Credit points and marks	5 credit points are awarded within the module. The grading of the examination and the marking are regulated in § 10 of the Examination Regulations.
Frequency	The module is offered every academic year in the summer semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Printed Functionalities, specialisation module electives/ Soft skills

Module number	231631-002 (Version 03)
Module name	Printing Processes
Responsible for the module	Professorship of Print Media Technology
Contents and qualification objectives	<p><u>Contents:</u> The module provides an overview of processes in the area of printing processes. The lecture includes: Systematics and overview of the process stages and process variants, printing form production, imaging, conventional printing processes, digital printing processes, print finishing, drying and layering, print quality, application scenarios and requirements, process characteristics.</p> <p>The lab courses include: The students make practical tests on printing machines. Print samples are produced and evaluated and the influence of the process characteristics is examined.</p> <p><u>Qualification objectives:</u> The students demonstrate a deep understanding of the systematics, function and application scenarios of modern and current printing processes. They are capable of penetrating the subject area from an engineering perspective.</p>
Teaching formats	<p>The teaching format are lectures (V) and lab courses (P).</p> <ul style="list-style-type: none"> • V: Printing and Processes (2 LVS) • P: Printing and Processes (2 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of:</p> <ul style="list-style-type: none"> • 30-minute oral examination on Printing Processes (examination number: 31302). <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the summer semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Printed Functionalities, specialisation module electives/ Soft skills

Module number	231631-003 (Version 02)
Module name	Printed Electronics & Special Topics of Functional Printing
Responsible for the module	Professorship of Print Media Technology
Contents and qualification objectives	<p><u>Contents:</u> The course Printed Electronics gives an overview about the basics of the comparable young research field Printed Electronics – including typical materials, printed electronic devices, modules and systems. The course consists of the following main topics: technologies for the realization of structured and non-structured thin films and layers; materials used for printed electronics, e.g. functional polymers, small molecules, nano-materials for conductive, semi conductive, dielectric layers; device set-up, functionality and characterization (e.g. for organic field effect transistors, solar cells, batteries, super caps, sensors, loudspeakers). In the seminar Special Topics of Functional Printing, students have the opportunity to focus on special matters related to the lecture or current ongoing research in the field of printed electronics. They will give an own presentation to one special topic. Additional presentations will be given by internal and external researchers.</p> <p><u>Qualification objectives:</u> Students acquire a deep knowledge about the systematics, the working principles and the applications of functional printing and printed electronics.</p>
Teaching formats	<p>The teaching format are lectures (V) and seminar (S).</p> <ul style="list-style-type: none"> • V: Printed Electronics (2 LVS) • S: Special Topics of Functional Printing (2 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of:</p> <ul style="list-style-type: none"> • 30-minute written examination on Printed Electronics & Special Topics of Functional Printing (Examination number: 31347). <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the summer semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Printed Functionalities, specialisation module electives/ Soft skills

Module number	244038-055 (Version 03)
Module name	Automotive Sensor Systems
Responsible for the module	Professorship of Electrical Measurements and Sensor Technology
Contents and qualification objectives	<p><u>Contents:</u></p> <ul style="list-style-type: none"> • General aspects of the use of sensors in automobiles • Sensors for engine management • Sensors for the chassis • Sensors for active and passive safety (e.g. ABS, ESP) • Driver Assistance Systems • Sensors for air quality monitoring • Exhaust gas sensors • Sensors for acceleration, force, pressure, speed • Self-monitoring and self-calibration for robustness <p><u>Qualification objectives:</u></p> <ul style="list-style-type: none"> • Gain an overview of various principles and possibilities of realization of Sensors for automotive applications • Methodology and preparation of technical reports <p>The students have an overview of various principles and realisation possibilities of sensors for automotive applications. They can carry out a targeted literature search, summarise the information gathered in a written technical report and are able to present this to an audience.</p>
Teaching formats	<p>The teaching format are lectures (V) and seminar (S).</p> <ul style="list-style-type: none"> • V: Automotive Sensor Systems (1 LVS) • S: Automotive Sensor Systems (3 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	Successful passing of the module examination is a prerequisite for the award of credit points.
Module examination	<p>The module examination consists of two examination papers. In detail, the following examination papers are to be completed:</p> <ul style="list-style-type: none"> • 20-minute oral examination on Automotive Sensor Systems (examination number: 42013) • written elaboration (technical report) on Automotive Sensor Systems (scope: 2 pages, processing time: 1 week) (examination number: 42004) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p> <p>Examination:</p> <ul style="list-style-type: none"> • oral exam on Automotive Sensor Systems, weighting 1 • written elaboration (technical report) on Automotive Sensor Systems, weighting 1
Frequency	The module is offered every academic year in the summer semester.

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Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Printed Functionalities, specialisation module electives/ Soft skills

Module number	231631-005 (Version 02)
Module name	Media Physics
Responsible for the module	Professorship of Print Media Technology
Contents and qualification objectives	<p><u>Contents:</u> The module gives a deeper insight into the relationships between information and physical media in general. The lecture includes: structures and their production, characterization and properties, information and modulation, noise and roughness, coding, scales, complexity and emergence, definitions of information, entropy, order, etc.</p> <p>In the seminar, students work on current topics with the help of current scientific publications from the lecture area and present and discuss the results in seminar papers.</p> <p><u>Qualification objectives:</u> The student acquires a deep understanding of structures and information and therefore, is able to classify the new connection possibilities of the printed functionalities.</p>
Teaching formats	<p>The teaching format are lectures (V) and seminar (S)</p> <ul style="list-style-type: none"> • V: Media Physics (2 LVS) • S: Media Physics (2 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of an examination:</p> <ul style="list-style-type: none"> • 30-minute oral exam on Media Physics (examination number: 31311) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the summer semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Printed Functionalities, specialisation module electives/ Soft skills

Module number	231631-004 (Version 03)
Module name	Printing Presses
Responsible for the module	Professorship of Print Media Technology
Contents and qualification objectives	<p><u>Contents:</u> The module gives an overview of materials and machines in the area of printing processes. The lecture includes part I: Machines: Systematics and overview of the machine components and variants in the different process stages, design of the material flow of printing and printing material, web guiding, machine and process control, characteristic assemblies, precision, special features in production. Part II: Material properties: Mechanical properties of flexible and rigid substrates, substrate rheology, dynamic behavior in layer formation, material transport and drying. In the practical training, the content of the material is deepened in calculation examples and tasks for the configuration and design of machines and processes.</p> <p><u>Qualification objectives:</u> Students will get deep knowledge about the systematics, function and application scenarios of the modern and current printing press devices. They should be empowered to penetrate the field of engineering science.</p>
Teaching formats	<p>The teaching format are lectures (V) and exercises (Ü).</p> <ul style="list-style-type: none"> • V: Printing Presses (3 LVS) • Ü: Printing Presses (1 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of:</p> <ul style="list-style-type: none"> • 30-minute oral examination on Printing Presses (examination number: 31303). <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the winter semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Printed Functionalities, specialisation module electives/ Soft skills

Module number	231631-006 (Version 02)
Module name	Research Lab
Responsible for the module	Professorship of Print Media Technology
Contents and qualification objectives	<p><u>Contents:</u> The class prepares for the Applied Engineering Project and the master thesis. In the lab course, the students receive a research task, which has to be investigated independently in a small team of students under supervision. The students perform a literature research, experiments in the labs of the university, and present the results of their research in a report. In a group work, the contribution of each student must be highlighted.</p> <p>With the supervision of the Research Lab, background knowledge of the research topic, the laboratory equipment and the scientific work is given.</p> <p><u>Qualification objectives:</u> The objective of the Research Lab is to teach the student to work scientifically in a team and to prepare for Applied Engineering Project and their master thesis.</p>
Teaching formats	<p>The teaching format is lab courses.</p> <ul style="list-style-type: none"> • P: Research Lab (4 LVS) <p>The teaching events will be held in the English language. The course schedule is planned individually. The student has to prove sufficient knowledge in preparative discussions.</p>
Preconditions for participation (recommended knowledge and skills)	The core module Advanced Manufacturing, the Printing Processes module (231631-002) and the Printed Electronics & Special Topics of Functional Printing (231631-003) should have been completed successfully
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of:</p> <ul style="list-style-type: none"> • 30 minute oral examination with questions about the work done during the Research Lab examination number: 31348 <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the winter semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Printed Functionalities, specialisation module electives/ Soft skills

Module number	212001-335 (Version 01)
Module name	Surfaces, Thin Films and Interfaces
Responsible for the module	Professorship Experimental Physics with Focus Technical Physics
Contents and qualification objectives	<p><u>Contents:</u> The module Surfaces, Thin Films and Interfaces deals with the following topics among others:</p> <ul style="list-style-type: none"> • Crystalline and electronic structure of surfaces (reconstruction, relaxation, superstructures, surface states, etc.) • Experimental methods for analysing surfaces (electron diffraction, electron spectroscopy, scanning probe microscopy, etc.) • Fundamentals of film deposition and preparation of surfaces • Fundamentals of vacuum technology <p><u>Qualification objectives:</u></p> <ul style="list-style-type: none"> • Understanding of physical relationships • Skills in physical modelling • Knowledge and understanding of characteristic approaches • Ability to work independently with specialised scientific literature
Teaching formats	<p>The teaching format are lectures and exercises.</p> <ul style="list-style-type: none"> • V: Surfaces, Thin Films and Interfaces (2 LVS) • E: Surfaces, Thin Films and Interfaces (2 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	Students should be familiar with the basics of atomic and solid state physics.
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of:</p> <ul style="list-style-type: none"> • 60-minute written examination on the contents of the module (examination number: 11715) <p>The examination must be taken in the English language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the winter semester.
Workload	The module comprises a students' workload of 150 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Electives/Soft skills

Module number	136004-016 (Version 01)
Module name	Deutsch für Ingenieure (Niveau B1+)
Responsible for the module	Head of the Department- Deutsch als Fremdsprache of the Center for Foreign Languages
Contents and qualification objectives	<p><u>Contents:</u></p> <ul style="list-style-type: none"> • Practise all language skills such as listening, speaking, reading and writing using selected technical language and everyday study-related topics from the engineering context • Practising formal and informal written and especially oral communication in everyday student and professional life (e.g. job application training, communication in the workplace) • Consolidation and expansion of grammatical structures through exercises on lexical and morpho-syntactic structures <p>The course is based on language competence level B1 of the Common European Framework of Reference for Languages (CEFR).</p> <p><u>Qualification objectives:</u></p> <ul style="list-style-type: none"> • Understand the main content of common texts on engineering topics • Understand and write texts on professional topics • report on experiences and events in an engineering context using simple linguistic means • describe, justify and explain simple processes • present their own point of view on familiar engineering topics <p>Completion of the module corresponds to language competence level B1 of the Common European Framework of Reference for Languages (CEFR).</p>
Teaching formats	<p>Teaching forms of the module are exercises.</p> <ul style="list-style-type: none"> • E: Work related language course Deutsch für Ingenieure (4 LVS) • E: Practical training in German (2 LVS)
Preconditions for participation (recommended knowledge and skills)	Completed previous course 3 or placement test (qualification recommendation)
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of two examinations. The following examinations must be completed:</p> <p>Recognisable academic performance:</p> <ul style="list-style-type: none"> • 70-minute written examination on the professional language course German for Engineers (examination number: 91833) • 15-minute oral examination on the practical German language course (examination number: 91834) <p>The academic performance is credited if the grade of the academic performance is at least 'sufficient'.</p>

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Credit points and marks	5 credit points are awarded within the module. The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations. Examination achievements: Recognisable academic performance: <ul style="list-style-type: none">• Written exam on the professional language course German for Engineers, Weight 7• Oral examination on the practical German course, Weight 3
Frequency	The module is offered in every semester in an academic year
Workload	The module comprises a students' workload of 150 WH (working hours) (60 Contact hours and 90 Self-study hours)
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Electives/Soft skills

Module number	136004-007 (Version 02)
Module name	Deutsch als Fremdsprache III (Niveau B1)
Responsible for the module	Head of the Department- Deutsch als Fremdsprache of the Center for Foreign Languages
Contents and qualification objectives	<p><u>Contents:</u></p> <ul style="list-style-type: none"> • Exercises to expand vocabulary and improve speaking skills • Communicative situations and tasks on topics such as time and wasting time, leisure time, daily routine, studies, work and profession, modern media • Repetition and consolidation of basic grammar and teaching of further grammatical structures, e.g. passive voice, subordinate clauses <p>The course is based on language competence level B1 of the Common European Framework of Reference for Languages (CEFR).</p> <p><u>Qualification objectives:</u></p> <ul style="list-style-type: none"> • Improve speaking skills, make simple and coherent statements about familiar topics • Report on experiences and events, describe goals and plans, give reasons and explanations • Communicating with the help of simple linguistic means • Understanding and writing texts on everyday topics <p>Completion of the module corresponds to language competence level B1 of the Common European Framework of Reference for Languages (CEFR).</p>
Teaching formats	Teaching forms of the module are exercises. <ul style="list-style-type: none"> • E: Course 3 (4 LVS)
Preconditions for participation (recommended knowledge and skills)	Completed previous course 2 or placement test (qualification recommendation)
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	The module examination consists of the following exam: Recognisable academic performance: <ul style="list-style-type: none"> • 90-minute written exam of Course 3 (examination number: 91805) The academic performance is recognised if the grade of the academic performance is at least 'sufficient'.
Credit points and marks	5 credit points are awarded within the module. The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.
Frequency	The module is offered in every semester in an academic year
Workload	The module comprises a students' workload of 150 WH (working hours) (60 Contact hours and 90 Self-study hours)
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Electives/Soft skills

Module number	136001-004 (Version 02)
Module name	Englisch in Studien- und Fachkommunikation III (Niveau C1)
Responsible for the module	Head of the English Department of the Center for Foreign Languages
Contents and qualification objectives	<p><u>Contents:</u> Consolidation of specialised vocabulary in selected areas and systematic expansion of general vocabulary with reference to study- and career-oriented as well as intercultural issues, leading consultations and discussions, giving presentations; The programme is based on language competence level C1 of the Common European Framework of Reference for Languages (CEFR) and includes a technical language component</p> <p><u>Qualification objectives:</u> Confidence in the oral and written exchange of information and in oral and written expression, confidence in presentations, acquisition of intercultural competences; Completion of the module corresponds to language competence level C1 of the Common European Framework of Reference for Languages (CEFR) with a technical language orientation.</p>
Teaching formats	<p>Teaching forms of the module are exercises.</p> <ul style="list-style-type: none"> • E: Course 3 Advanced English in job-related situations (4 LVS)
Preconditions for participation (recommended knowledge and skills)	Completion of the module English in Academic and Specialised Communication II (level B2) or placement test (qualification recommendation)
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of two exams which must be completed: Recognisable academic performance:</p> <ul style="list-style-type: none"> • 20-minute written exam for course 3 (examination number: 91203) • 30-minute oral examination (presentation) for course 3 (examination number: 91225) <p>The coursework is credited if the grade of the coursework is at least 'sufficient'.</p>
Credit points and marks	<p>5 credit points are awarded within the module. The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations. Examinations: Recognisable academic performance</p> <ul style="list-style-type: none"> • Written exam for course 3, weighting 4 (4 CP) • Oral examination (presentation) for course 3, weighting 1 (1 CP)
Frequency	The module is offered in every semester in an academic year
Workload	The module comprises a students' workload of 150 WH (working hours) (60 Contact hours and 90 Self-study hours)
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Electives/Soft skills

Module number	136001-006 (Version 02)
Module name	Englisch in Studien- und Fachkommunikation V (Niveau C1)
Responsible for the module	Head of the English Department of the Center for Foreign Languages
Contents and qualification objectives	<p><u>Contents:</u> Teaching advanced knowledge and skills in the scientific and technical use of the English language with a focus on the linguistic and stylistic requirements of a technical working environment.</p> <p>The programme is based on language competence level C1 of the Common European Framework of Reference for Languages (CEFR) and includes a technical language component.</p> <p><u>Qualification objectives:</u> Professionalisation in the use of English as a scientific language; training and expansion of communicative and interactive skills; confidence in presentations in compliance with formal criteria; achieving a stylistic range of variation in oral and written expression</p> <p>Completion of the module corresponds to language competence level C1 of the Common European Framework of Reference for Languages (CEFR) with a technical language orientation.</p>
Teaching formats	<p>Teaching forms of the module are exercises.</p> <ul style="list-style-type: none"> • E: Course 4 Scientific Writing and Speaking (4 LVS)
Preconditions for participation (recommended knowledge and skills)	Completion of the module English in Academic and Specialised Communication II (level B2) or placement test (qualification recommendation)
Applicability of the module	---
Preconditions for the award of credit points	<p>The fulfilment of the admission requirements for the examination and the successful completion of the module examination are prerequisites for the award of credit points.</p> <p>The admission requirement is the following preliminary examination (can be repeated indefinitely):</p> <ul style="list-style-type: none"> • Academic paper (length: 1000-1500 words, workload: 60 AS) in course 4
Module examination	<p>The module examination consists of one examination:</p> <p>Recognisable academic performance:</p> <ul style="list-style-type: none"> • 30-minute oral group examination for course 4 (examination number: 91219) <p>The academic performance is recognised if the grade of the academic performance is at least 'sufficient'.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered in every semester in an academic year
Workload	The module comprises a students' workload of 150 WH (working hours) (60 Contact hours and 90 Self-study hours)
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Electives/Soft skills

Module number	136001-007 (Version 02)
Module name	Englisch in Studien- und Fachkommunikation VI (Niveau C1)
Responsible for the module	Head of the English Department of the Center for Foreign Languages
Contents and qualification objectives	<p><u>Contents:</u> Independent research, reading and linguistic evaluation of subject-specific texts as well as application in technical discussions. Consolidation of academic/professional vocabulary in the specialised field, leading consultations and discussions in a technical working environment.</p> <p>The programme is based on language competence level C1 of the Common European Framework of Reference for Languages (CEFR) and includes a technical language component.</p> <p><u>Qualification objectives:</u> Independent reception of specialist texts and use of specialist terminology, presentation of subject-specific facts and leading discussions on the topic, professionalization in the use of English as a scientific language. Completion of the module corresponds to language competence level C1 of the Common European Framework of Reference for Languages (CEFR) with a technical language orientation</p>
Teaching formats	<p>Teaching forms of the module are tutorials.</p> <ul style="list-style-type: none"> • T: Course 5 Subject-specific Reading (4 LVS)
Preconditions for participation (recommended knowledge and skills)	Completion of the module English in Academic and Specialised Communication II (level B2) or placement test (qualification recommendation)
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of one examination:</p> <p>Recognisable academic performance:</p> <ul style="list-style-type: none"> • 30-minute oral summary of a specialised text and discussion of the topic as part of three tutorials in course 5 (examination number: 91227) <p>The academic performance is recognised if the grade of the academic performance is at least 'sufficient'.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <ul style="list-style-type: none"> • The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.
Frequency	The module is offered in every semester in an academic year
Workload	The module comprises a students' workload of 150 WH (working hours) (10 Contact hours and 140 Self-study hours)
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Electives/Soft skills

Module number	136005-001 (Version 02)
Module name	Französisch I (Niveau A1)
Responsible for the module	Head of the French Department of the Center for Foreign Languages
Contents and qualification objectives	<p><u>Contents:</u></p> <ul style="list-style-type: none"> • Teaching basic knowledge of the French language (lexis, grammar, phonetics) and regional/cultural characteristics • Vocabulary of simple topics: Family and friends, language skills, daily routine, eating habits, leisure activities, place of residence/accommodation • Grammatical structures: articles, nouns, adjectives, adverbs, tenses (présent and passé composé), personal pronouns, negation • Communication structures: introducing/describing yourself and others, describing/asking for directions, expressing simple goals, reporting on the past • The course is based on language competence level A1 of the Common European Framework of Reference for Languages (CEFR). <p><u>Qualification objectives:</u> Students can understand and use everyday expressions and very simple sentences aimed at satisfying specific needs. They can introduce themselves and others and ask other people questions about themselves. Completion of the module corresponds to language competence level A1 of the Common European Framework of Reference for Languages (CEFR).</p>
Teaching formats	<p>Teaching forms of the module are exercises.</p> <ul style="list-style-type: none"> • E: Course 1 (4 LVS)
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of one examination: Recognisable academic performance:</p> <ul style="list-style-type: none"> • 90-minute written examination for course 1 (examination number: 91301) <p>The academic performance is recognised if the grade of the academic performance is at least 'sufficient'.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <ul style="list-style-type: none"> • The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.
Frequency	The module is offered in every semester in an academic year
Workload	The module comprises a students' workload of 150 WH (working hours) (60 Contact hours and 90 Self-study hours)
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Electives/Soft skills

Module number	136005-002 (Version 02)
Module name	Französisch II (Niveau A2)
Responsible for the module	Head of the French Department of the Center for Foreign Languages
Contents and qualification objectives	<p><u>Contents:</u></p> <ul style="list-style-type: none"> • Expansion and consolidation of vocabulary and grammar • Regional/cultural specialities • Vocabulary: education, family, hobbies, leisure and work • Grammatical structures: (non-)regular verbs, comparative adjectives and adverbs, modal verbs, reflexive verbs, possessive pronouns, demonstrative antecedents, direct and indirect object pronouns, adverbial pronouns y and en, relative pronouns, futur composé, comparison of imparfait and passé composé • Communication structures: talking about habits, making suggestions, making plans, reporting on and evaluating experiences <p>The course is based on language competence level A2 of the Common European Framework of Reference for Languages (CEFR).</p> <p><u>Qualification objectives:</u> Students can understand sentences and frequently used expressions related to their area of life. They can communicate orally and in writing in simple routine situations. Completion of the module corresponds to language competence level A2 of the Common European Framework of Reference for Languages (CEFR).</p>
Teaching formats	Teaching forms of the module are exercises. <ul style="list-style-type: none"> • E: Course 2 (4 LVS)
Preconditions for participation (recommended knowledge and skills)	Completed previous course 1 or placement test (qualification recommendation)
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	The module examination consists of one examination: Recognisable academic performance: <ul style="list-style-type: none"> • 90-minute written examination for course 2 (examination number: 91302) • The academic performance is recognised if the grade of the academic performance is at least 'sufficient'.
Credit points and marks	5 credit points are awarded within the module. <ul style="list-style-type: none"> • The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.
Frequency	The module is offered in every semester in an academic year
Workload	The module comprises a students' workload of 150 WH (working hours) (60 Contact hours and 90 Self-study hours)
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Electives/Soft skills

Module number	136009-001 (Version 02)
Module name	Spanisch I (Niveau A1)
Responsible for the module	Head of the Spanish Department of the Center for Foreign Languages
Contents and qualification objectives	<p><u>Contents:</u></p> <ul style="list-style-type: none"> • Teaching basic knowledge of the Spanish language (lexis, grammar, phonetics) and regional/cultural characteristics • Vocabulary on simple topics: Family and friends, language skills, daily routine, eating habits, leisure activities, place of residence/accommodation • Grammatical structures: articles, nouns, adjectives, adverbs, tenses (presente and pretérito perfecto), personal pronouns, negation • Communication structures: introducing/describing yourself and others, describing/asking directions, expressing simple goals, reporting on the past <p>The course is based on language competence level A1 of the Common European Framework of Reference for Languages (CEFR).</p> <p><u>Qualification objectives:</u> Students can understand and use everyday expressions and very simple sentences aimed at satisfying specific needs. They can introduce themselves and others and ask other people questions about themselves. Completion of the module corresponds to language competence level A1 of the Common European Framework of Reference for Languages (CEFR).</p>
Teaching formats	Teaching forms of the module are exercises. <ul style="list-style-type: none"> • E: Course 1 (4 LVS)
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	The module examination consists of one examination: Recognisable academic performance: <ul style="list-style-type: none"> • 90-minute written examination for course 1 (examination number: 91601) The academic performance is recognised if the grade of the academic performance is at least 'sufficient'.
Credit points and marks	5 credit points are awarded within the module. The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.
Frequency	The module is offered in every semester in an academic year
Workload	The module comprises a students' workload of 150 WH (working hours) (60 Contact hours and 90 Self-study hours)
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Electives/Soft skills

Module number	136009-002 (Version 02)
Module name	Spanisch II (Niveau A2)
Responsible for the module	Head of the Spanish Department of the Center for Foreign Languages
Contents and qualification objectives	<p><u>Contents:</u></p> <ul style="list-style-type: none"> • Expansion and consolidation of lexis and grammar • Regional/cultural specialities • Lexic: education, family, hobbies, leisure and work • Grammatical structures: (non-)regular verbs, modal verbs, reflexive verbs, possessive pronouns, direct and indirect personal pronouns, relative pronouns, comparison of pretérito indefinido and perfecto • Communication structures: talking about habits, making suggestions, making plans, reporting and evaluating experiences <p>The course is based on language competence level A2 of the Common European Framework of Reference for Languages (CEFR).</p> <p><u>Qualification objectives:</u> Students can understand sentences and frequently used expressions related to their area of life. They can communicate orally and in writing in simple routine situations.</p> <p>Completion of the module corresponds to language competence level A2 of the Common European Framework of Reference for Languages (CEFR).</p>
Teaching formats	Teaching forms of the module are exercises. E: Course 2 (4 LVS)
Preconditions for participation (recommended knowledge and skills)	Completed previous course 1 or placement test (qualification recommendation)
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of one examination: Recognisable academic performance:</p> <ul style="list-style-type: none"> • 90-minute written examination for course 2 (examination number: 91602) <p>The academic performance is recognised if the grade of the academic performance is at least 'sufficient'.</p>
Credit points and marks	5 credit points are awarded within the module. The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.
Frequency	The module is offered in every semester in an academic year
Workload	The module comprises a students' workload of 150 WH (working hours) (60 Contact hours and 90 Self-study hours)
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation modules Electives/ Soft skills

Module number	231833-010 (Version 01)
Module name	Electroplating and Thermal Coating
Responsible for the module	Chair of Materials and Surface Engineering
Contents and qualification objectives	<p><u>Contents:</u> The module follows on from the 'Surface and Interface Engineering' module in terms of content and expands on this with regard to industrially relevant coating processes. The focus here is on the topics of 'Electroplating' and 'Thermal Coating'.</p> <p>Electroplating: Relevant topics of wet-chemical coating processes are addressed and comprehensively taught. Contents are</p> <ul style="list-style-type: none"> • Electrochemical fundamentals • Modelling of electrochemical processes • Fundamentals of electroplating technology • Coating systems • Coating processes • Electrochemical analysis • Coating characterisation <p>Thermal coating: The following thermal coating processes or groups of coating processes are analysed in more detail:</p> <ul style="list-style-type: none"> • Thermal spraying • Deposition welding • CVD process • PVD process <p>For these coating processes, the environmental relationships of the coating process and cross-process issues relating to the selection methodology for coatings are dealt with.</p> <p>As both galvanic and thermal coatings are primarily used in tribological and/or chemical applications, the fundamentals of wear and corrosion are dealt with on the basis of corresponding applications and the potential for wear and corrosion protection on the coating side is derived and presented. However, surface coatings can also be used to specifically change a number of other properties (electrical and thermal conductivity, physical behaviour, colour, gloss, etc.), which is why these properties are also discussed in the course of this module.</p> <p><u>Qualification objectives:</u></p> <p>Electroplating: Students master the essential processes of pre- and post-treatment as well as layer formation. This enables them to select coating systems for specific applications and to optimise processes.</p> <p>Thermal coating: Students are familiar with various groups of thermal coating processes that are specifically relevant to industry. They are able to correlate possible coating and substrate materials, coating formation and adhesion mechanisms and the resulting coating properties with the applicable coating processes and thus make a process and material selection for a possible thermal coating process based on the requirements profile for technical surfaces.</p>

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Teaching formats	Teaching forms of the module are lectures(L), exercises(E) and internship(I). <ul style="list-style-type: none"> • L: Electroplating and Thermal Coating (2 LVS) • E: Electroplating and Thermal Coating (2 LVS) • I: Electroplating and Thermal Coating (2 LVS) The teaching events will be held in the English language.
Preconditions for participation (recommended knowledge and skills)	Knowledge of the fundamentals of materials technology, surface technology/coating technology
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	The module examination consists of the following exams: <ul style="list-style-type: none"> • 120 minute written exam on Electroplating and Thermal Coating (examination number: 32512) The examination must be taken in the English language.
Credit points and marks	5 credit points are awarded within the module. The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.
Frequency	The module is offered every academic year in the winter semester.
Workload	The module comprises a students' workload of 150 WH (working hours)
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation modules Electives/ Soft skills

Module number	231431-013 (Version 02)
Module name	Applied Modelling and Simulation in Solid Mechanics II
Responsible for the module	Professorship of Solid Mechanics
Contents and qualification objectives	<p><u>Contents:</u> The module covers the fundamentals of geometrically and physically non-linear continuum mechanics and material modelling. Furthermore, an introduction to the non-linear finite element method (FEM) is given, whereby the focus is on the application of commercial FEM programmes.</p> <ul style="list-style-type: none"> • Eulerian and Lagrangian description methods • Distortion and stress tensors, time derivatives of tensors • Rheological equivalent models, non-linear elasticity, viscoelasticity and plasticity • Solution algorithm of the non-linear FEM • Contact <p><u>Qualification objectives:</u> After successfully completing the module, students will be able to calculate non-linear problems in solid mechanics and thus carry out the activities of a development and calculation engineer in the field of computer-aided component simulation.</p>
Teaching formats	<p>Teaching forms of the module are lectures(L) and exercises(E).</p> <ul style="list-style-type: none"> • L: Applied Modelling and Simulation in Solid Mechanics II (2 LVS) • E: Applied Modelling and Simulation in Solid Mechanics II (2 LVS) <p>The teaching events will be held in the English language.</p>
Preconditions for participation (recommended knowledge and skills)	Knowledge of Applied Modelling and Simulation in Solid Mechanics I
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of the following exams:</p> <ul style="list-style-type: none"> • 30-minute oral exam on Applied Modelling and Simulation in Solid Mechanics II (examination number: 31820) <p>The examination can be taken either in the English or German language.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered every academic year in the winter semester.
Workload	The module comprises a students' workload of 150 WH (working hours)
Duration of the module	In a regular course of studies, the module extends to one semester.

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Specialisation module Electives/ Soft skills

Module number	231231-011 (Version 01)
Module name	Angewandte Arbeitswissenschaft Applied Human Factors
Responsible for the module	Professorship of Industrial Engineering and Innovation Management
Contents and qualification objectives	<p><u>Contents:</u> In this module, selected concepts and methods of human-centred design of (socio)technical systems are presented in depth. The application of the concepts and methods is considered for specific fields of action and newly established technologies and categorised in the current scientific discourse.</p> <p>The aim is to design products, work equipment and complex systems that are user-friendly, fit for purpose and ethically sound. Specialists and managers in the fields of strategic management, technology management, development and design, ergonomics, product and occupational safety, etc. need the relevant skills.</p> <p>The main topics are</p> <ul style="list-style-type: none"> • Fundamentals of human-centred system design • Human-centred design of mobility (driver-vehicle interaction, automated driving, multimodal mobility, etc.) • Human-centred design of industrial and service robotics • Utilisation and design of virtual and mixed reality • Interaction with artificial intelligence and machine learning • Change in the human-technology division of labour and collaboration <p><u>Qualification objectives:</u> Students are familiar with concepts and have mastered selected methods of human-centred design of technical systems in selected fields of application. They can categorise and apply these in practice and reflect on the results of their application.</p>
Teaching formats	<p>Teaching forms of the module are lectures and exercises.</p> <ul style="list-style-type: none"> • L: Angewandte Arbeitswissenschaft Applied Human Factors (2 LVS) • E: Angewandte Arbeitswissenschaft Applied Human Factors (2 LVS) <p>The teaching events are held in German during the summer semester and in English during the winter semester.</p>
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.
Module examination	<p>The module examination consists of one examination- oral examination in small groups (15 minutes per student) on Applied Human Factors (examination number: 31224)</p> <p>The examination can be held in German or English.</p>
Credit points and marks	<p>5 credit points are awarded within the module.</p> <p>The grading of the examination and the generation of the mark is regulated in § 10 of the Examination Regulations.</p>
Frequency	The module is offered in every semester in an academic year.
Workload	The module comprises a students' workload of 150 WH (working hours)
Duration of the module	In a regular course of studies, the module extends to one semester.

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Research module- Applied Engineering Project

Module number	5230100-860 (Version 02)
Module name	Applied Engineering Project
Responsible for the module	Dean of Studies Advanced Manufacturing at the Faculty of Mechanical Engineering
Contents and qualification objectives	<p><u>Contents:</u> The module deals with the independent and systematic processing of a research-oriented, practical task from the field of Advanced Manufacturing using the knowledge acquired so far. The task is usually provided by a regional company (practice partner) and the task should be worked on in a team and supervised by a professor involved in the degree programme.</p> <p>The work can be carried out (a) in an experimental field or laboratory located at the professorship or (b) externally as an industrial placement in a research-related area. In addition to the technical issues of the respective task, students should also be introduced to methodological and practical problems and their solutions in the field of research, taking into account scientific standards. The task can be worked on individually or preferably in a team.</p> <p>Accompanying excursions to regional companies are offered.</p> <p><u>Qualification objectives:</u> Students familiarise themselves with regional mechanical engineering companies and their current development needs. They are able to familiarise themselves independently with relevant technological problems of a company and to develop user-oriented solutions in a team using scientific methods and to present these in written and oral form by working on the research project; students are made aware of the importance of methods for organisation and problem solving in research-oriented groups. Requirements are placed on the ability to analyse and solve problems as well as on time and project management.</p>
Teaching formats	<p>Teaching forms of the module are project(P) and excursion(E).</p> <ul style="list-style-type: none"> • P: Applied Engineering Project (15 weeks during the semester) (2 LVS) • E: Field trips to regional companies (1 LVS) • Consultations with the supervisor can be organised for support.
Preconditions for participation (recommended knowledge and skills)	None
Applicability of the module	---
Preconditions for the award of credit points	The successful passing of the module examination is the precondition for the award of credit points.

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Module examination	The module examination consists of two examinations. The following examinations must be completed: <ul style="list-style-type: none">• Project work (written elaboration; length: approx. 15 pages per student, completion time: 15 weeks) (examination number: LM_Ad-8130)• 30-minute oral examination, consisting of a 15-minute presentation followed by a 15-minute discussion (examination number: LM_Ad-8140)
Credit points and marks	10 credit points are acquired in the module. The assessment of the examinations and the calculation of the module grade are regulated in § 10 of the examination regulations. Examination achievements: <ul style="list-style-type: none">• Project work, weighting 7 - pass required• Oral examination, consisting of a presentation followed by a discussion, weighting 3 - pass required
Frequency	The module is offered in every semester in an academic year.
Workload	The module comprises a students' workload of 300 WH (working hours).
Duration of the module	In a regular course of studies, the module extends to one semester.

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Module Master Thesis

Module number	230100-960 (Version 02)
Module name	Master Thesis
Responsible for the module	Dean of Studies Advanced Manufacturing at the Faculty of Mechanical Engineering
Contents and qualification objectives	<p><u>Contents:</u> With the Master thesis, students should apply the knowledge they have acquired to a scientific task and thereby demonstrate their research skills. The given time frame and available resources must be taken into account. On the one hand, the written presentation of the thesis describes the field of research in a general sense in order to place the task in a wider context. On the other hand, it is written concisely and with scientific precision in order to present the solution and the procedure leading to it in a comprehensible manner. The task must be appropriate to the given scope of the thesis and chosen in consultation with the academic supervisor.</p> <p>The Master thesis can be carried out both at the university and in industry. However, the latter is only possible if a university lecturer from the Faculty of Mechanical Engineering has agreed to supervise the thesis in advance. The examination board decides on the appointment of university lecturers from other faculties as supervisors.</p> <p>In addition, a seminar is held to teach students how to present research results and prepare application documents in German, in particular to prepare them for entering the German labour market.</p> <p><u>Qualification objectives:</u> Upon successful completion of the module, students will have demonstrated that they are able to</p> <ul style="list-style-type: none"> • independently apply the theoretical and application-oriented specialist knowledge acquired in the degree programme to a complex task from the field of mechanical engineering or independently acquire the new knowledge and skills required for the solution, • select suitable research methods, justify this selection and plan and responsibly carry out any necessary studies and experiments, • explain their own research results and interpret them critically in relation to a specification or the state of the art, • document the procedure and results of their research appropriately and according to scientific standards and present them in German.
Teaching formats	<p>The teaching form of the module is the seminar.</p> <ul style="list-style-type: none"> • S: Presentation and Communication for Engineers (2 LVS) <p>The seminar is offered in German. The seminar can also be organised as a block course.</p> <p>The Master thesis is to be completed through independent scientific work after an introduction to the tasks and objectives of the topic. Consultations with the supervisor of the Master thesis are to be attended for support.</p>
Preconditions for participation (recommended knowledge and skills)	Successful completion of module 136004-016 German for Engineers (level B1+) or at least comparable knowledge of the German language
Applicability of the module	---

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Preconditions for the award of credit points	<p>The fulfilment of the admission requirements for the individual examinations and the successful completion of the module examination are prerequisites for the award of credit points. The requirements are</p> <ul style="list-style-type: none"> • for the Master thesis examination: modules totalling 75 CP (credit points) • for the oral examination (presentation and colloquium on the results of the Master thesis): Modules totalling 90 CP and the Master thesis is graded at least 'sufficient'
Module examination	<p>The module examination consists of two examinations. The following examinations must be completed:</p> <ul style="list-style-type: none"> • Master thesis (length: approx. 80 pages, completion time: 23 weeks) (examination number: L_M_Ad-9110) The examination can be taken in German or English. • 45-minute oral examination: 15-minute presentation in German and 30-minute colloquium in German or English on the results of the Master thesis (examination number: L_M_Ad-9120)
Credit points and marks	<p>30 credit points are acquired in the module. The assessment of the examinations and the calculation of the module grade are regulated in § 10 of the examination regulations. Examination achievements:</p> <ul style="list-style-type: none"> • Master thesis, weighting 7 - pass required • Oral examination (presentation and colloquium on the results of the Master thesis), weighting 3 - pass required
Frequency	<p>The module is offered in every semester in an academic year.</p>
Workload	<p>The module comprises a student's workload of 900 WH (working hours).</p>
Duration of the module	<p>In a regular course of studies, the module extends to one semester.</p>