Module code	Module name	Short description	Semester	ECTS
Compulsory modules				
4DE-IMAPH-10	Engineering Mathematics / Technical Physics	The module aims to create solid theoretically and practically resilient basic knowledge, combined with the ability to solve simple tasks from the engineering, mechanical engineering, production and IT environment. In doing so, the basic arithmetic and algebra skills acquired in secondary education are put on a new basis; and the deeper meaning of analysis is pragmatically developed in the interest of the study goal of "Digital Engineering". The objective of the physics part is to consolidate basic knowledge of physics and technology and to get to know, grasp and understand it in a new way. Mathematics is regarded as a tool and instrument for this abstract physical modelling. Both disciplines serve to train the formal description of the environment with its manifold natural-scientific phenomena from a few simple basic facts. These methods and procedures of physical description of nature form the basis of the engineering sciences. Their knowledge, in particular basic knowledge, is essential for the proper description and design of technical systems.	1	8
4DE-ET-12	Electrical Engineering	The aim of the module is to grasp elementary electrical engineering as the physical-technical basis of "Digital Engineering" and to learn to understand and apply it. For this purpose, the necessary mathematics on the level of the admission requirements is used to support physical and electrotechnical model building in an algebraically abstract way. Subsequently, the students master all basic and advanced quantities of electrical engineering and the circuit diagram symbolism of the subject area as well as the mode of operation of elementary passive and active basic switching elements. Furthermore, they possess competences both for the calculation of simple linear electrical networks with stationary uniform and harmonic excitation and for the calculation of elementary transient processes. Special focus of the module is laid on the network analysis by means of complex alternating current calculation as a mathematical basis for avoiding the solution of differential equations.	1 und 2	7
4DE-AMA-20	Applied Mathematics	Based on the basic knowledge consolidated and extended in the module "Engineering Mathematics / Technical Physics (4DE-IMAPH-10)" in the first semester, this module further consolidates this knowledge at tertiary level in the interest of the objectives of higher mathematics. Regardless of the diversity required here, the mathematical basis for all other subject areas of the curriculum is to be laid: Beginning with algebraic structures as an elementary "instruction manual" for mathematics, continuing with the construct of differential equations for the description of numerous processes in natural and engineering sciences, up to approximation	2	6

		approaches according to Taylor and Fourier for technical functional dependencies, important subject areas will be covered. Integral transformations and their discrete variants represent the mathematical basis of today's digital signal processing systems. The analysis for functions with several independent variables promotes further applied mathematical basic understanding. Moreover, further important observation and analysis methods from statistics and stochastics are treated for the acquisition of random events, as they occur in industrial process measurement technology.		
4DE-TMFL-10	Engineering Mechanics and Strengths of Materials	In this module, students internalize the basics of strength theory and are able to apply them together with the knowledge of technical mechanics to the functional and economical design of machine parts. They are enabled to practically apply concepts and methods in the field of strength theory.	1	5
4DE-PROG-10	Foundations of Programming Technology / Object-oriented Programming	The module enables students to independently formulate simple problems in a procedural programming language and to translate and test the developed programs. Subsequently, special attention is paid to the development of an abstracting and object-oriented way of thinking. Practical exercises deepen the theoretical knowledge and train both algorithms and object-oriented structuring as well as programming techniques.	1	6
4DE-KCxWF	Design Theory / Cxx Techniques / Materials and Production Engineering	The module familiarizes students with formative principles from the scientific disciplines of mechanical and production engineering. Upon completion of the module, students will be able to create a simple construction in accordance with the set task and to design, construct and calculate selected machine elements. For this purpose, they acquire spatial imagination as well as the basic skills for producing technical drawings and understanding of the construction elements. Furthermore, students acquire knowledge of general methods and working techniques of 3D-CAD supported design. Upon completing the module, they are supposed to understand technical drawings and to create, manipulate and visualize three-dimensional CAD models and generate technical drawings from them. The main objectives of materials and production engineering are to teach students the basic properties, treatment possibilities and the use of different materials as well as techniques of materials testing and to enable them to select and use suitable production processes for company-specific applications.	1 und 2	11
4DE-DTEL-23	Digital Technology / Electronics	The module on digital technology includes the theory of digital representation, processing and storage of information on the basis of complete logical systems and, building on that, the technical implementation of simple combinatorial and sequential switching networks. The part on electronics deals with the functions and descriptions of typical components of analog electronics. Students are enabled to understand, analyze and calculate the operation of	2 und 3	8

		semiconductor components in simple and complex electronic discrete and integrated circuits. The integration of components and electronic circuits into a complex overall system and the understanding of signal generation and signal processing form the basis for this.		
4DE-DBN-30	Data Communication / Bus Systems / Network Technology	The module aims to provide students with a profound understanding of the problems involved in transmitting data via computer networks and bus systems. Algorithms and principles from the different layers of the OSI reference model are explained; their use is illustrated by means of practical examples.	3	6
4DE-MANWA-30	Self Management / Academic Work	Upon completion of the module, students will have gained basic knowledge of self and time management. They are able to independently reflect on these basic soft skills and to plan, coordinate and repeatedly analyze their personal study and working style. In addition, students get to know and apply the methodology of academic work.	3	4
4DE-SYSM-30	System Modelling / Software Engineering	The module aims to enable students to professionally plan and execute a complex system development process. The core competences to be acquired mainly include the mapping of components from the real into the digital world. Particular focus is laid on the modelling of requirements and applications. Computer-aided exercises deepen the understanding of the subject area and strengthen practical skills and abilities.	3	5
4DE-DBIDI-34	Databases / Internet Technologies / Data Protection and Information Security	The part on databases provides knowledge and skills of modelling, application and administration of relational database systems. In practical seminars in the computer lab, students can consolidate their skills on concrete database products thus deepening their knowledge. A further aim of this module is to enable students to classify, evaluate and test current Internet technologies with the aim of critically examining their possible applications in the field of industrial production systems and proposing their own solutions. The increasing need for protection of the data to be exchanged is of particular importance. This includes both the technical security of the increasingly complex systems and the concerns of data protection. The course aims to sensitize students to this topic and present the current state of the art in this field. Main focus is laid on mathematical basics of cryptographic methods. They are deepened to the extent necessary to understand the functionality of modern crypto algorithms.	3 and 4	12
4DE-RAES-40	Computer Architecture and Embedded Systems	The module aims to develop the ability to evaluate current structures and procedures of computer architecture and to design simple components of a computer system. The basic principles of each computer architecture are taught and deepened by means of a concrete instruction set architecture. Students learn the basics, structure and use of embedded systems in a systematic sequence. Starting with basic hardware architectures and system software for time-critical applications, the	4	5

		signal flow from the sensor system via the electronic components for signal processing and digitization of the application software for control and regulation tasks to the output to the periphery of the actuator system is shown. Exercises on the computer strengthen the practical skills and abilities.		
4DE-ABWL-40	Applied Business Administration	The module aims to impart business management basics and interrelationships. Starting from basic concepts and tasks of business administration, students are familiarized with the (success) goals of companies, the contents of constitutive decision-making processes and the management and execution system of companies. They will learn and apply important key business figures. In addition, students are taught the basics of operational accounting. They are enabled to apply selected instruments of cost accounting, investment calculation and cost management in a situation-specific and target-oriented manner.	4	5
4DE-IP-40	Industrial Processes	Upon completing the module, students will have acquired skills for efficient and reliable process design in the context of the digitalized world of work. With this module, students acquire skills, methods and tools of industrial engineering. They gain basic knowledge of process and data management in order to create the prerequisites for the digitalized working world and Industry 4.0.	4	6
4DE-PMQM-45	Project and Quality Management	Students are able to design, lead and successfully complete their own projects and to use computer-aided project management systems to complete tasks. Upon completing the module, students are also able to determine product characteristics for quality assurance. Another goal is to teach students the basic concerns and structure of a quality management system. The basis is provided by the ISO 9000 family of standards for structuring a QMS.	4 and 5	5
4DE-MSR-50	Measurement and Control Technology	Students learn the basics of measurement and control technology in a systematic sequence, starting from signal and system-theoretical abstraction approaches with linear, non-reactive transmission elements, via the description of the system behavior in original and image areas to the use of such "finished" devices and functional modules in production and manufacturing technology. In the subarea on sensor technology, participants learn, among other things, the transducer principles for the electrical measurement of non-electrical quantities, including the handling of current terminology on measurement uncertainty. The integration of functional units, such as measuring instruments for geometric variables, into a complex overall system, such as production engineering, as well as the understanding of signal acquisition and signal processing as a component of measurement and control technology form the basis. By imparting fundamental knowledge of the hardware and software of industrial controllers, students acquire	5	8

		basic knowledge of the use of control systems. Further module contents include the description of control loops and solution approaches with continuous and discontinuous control systems and digital control algorithms.		
4DE-SYSMOB-50	System Software and Mobile Applications	The module aims to impart fundamental knowledge of the architecture and functional principles of modern operating systems. Furthermore, students develop skills for an independent programming of mobile applications, including the interfaces and hardware components of the end devices. Students also obtain an overview of different implementation procedures and their application scenarios.	5	5
4DE-SICK-50	Language and Intercultural Communication	The module aims to impart professional, communicative, social and intercultural skills. Students are enabled to communicate in the field of "Digital Engineering" on an international level. Upon completing the module, students are capable of describing themselves and their professional and academic context in the foreign language. Furthermore, they are able to deal with everyday communication situations in their professional environment. Students can present their company with its basic processes and essential facts in written and oral form, using modern presentation techniques. They are qualified to work in international teams.		
4DE-RMV-56	Robotics und Machine Vision	The module provides basic knowledge for understanding the topic of robotics and industrial image processing and enables students to program robots independently. Among other things, focus is laid on robot-specific coordinate systems and their transformation. Machine Vision is used to introduce and train skills and abilities for machine object recognition.	5 and 6	7
4DE-PLDF-60	Production Logistics and Digital Factory	Upon completing the module, students are able to identify problems and interfaces along the value-added process for the manufacture of products and network them by means of innovative techniques. The increasing integration of distributed production processes in and between companies and company networks is the focus of the problem-solving strategies that are to be developed. With this module, students acquire basic knowledge of the analysis and optimization of material flows and the design of logistical processes. Upon completion of the module, students will have fundamental theoretical knowledge of the planning, design and optimization of processes along the value chain.	6	5
4DE-TBPI-60	Technical and Business Process Informatics	The students get to know practice-relevant tasks of operational information systems as well as process control engineering and visualization of production, supply and process engineering plants from industrial, service and utility companies and gain an overview of structures and functionalities of control engineering solutions from the perspective of process informatics. They recognize data and information flows between different, spatially distributed information sources and sinks as well as manual and machine data processing. Students are thus able to carry	6	7

		out analyses on the origin of information, identify media breaks and create future solution and migration approaches for complex and historically grown information and data structures. The reference architecture model Industry 4.0 (RAMI4.0) according to DIN SPEC 91345 is used as abstraction basis. At the same time, this module opens up the possibility to deal with special aspects and current technical development trends as well as norms and standardizations from various fields of digital engineering and thus to react to short-term needs of the practice partners. Under the guidance of tutors, students acquire special knowledge, represent it and participate in a professional group discussion. This gives graduates the chance to learn about the practical feasibility and application of almost all previous teaching contents from the curriculum of "Digital Engineering". Furthermore, students can acquire additional qualifications (such as REFA, Ada Certificate, language certificates, etc.).		
4DE-RECHT-60	Law	The module provides students with knowledge of the legal foundations of their practical and professional activities and enables them to classify legal problems in the legal system and to use the relevant legal provisions to solve them. For this purpose, case studies are used to introduce the systematics and application of German private law and the fundamentals of labor law with the special features of technical, medical and social occupational health and safety. Other intellectual property rights of individuals in the context of their intellectual creation are covered in the legal field of industrial property protection. Consideration must also be given to the protection of the environment, which is represented by environmental protection law (environmental law) as a branch of administrative law. Finally, students gain knowledge of the legal framework of information and communication technology with references to data protection law and competition law.	6	5
Practical modules				
4DE-PM1-10	Practical module 1 "Production, QM, Administrative and IT-related Processes of the Practice Company"	The first practical phase familiarizes students with their workplace, their practice company and elementary processes and activities. They deal with the production, QM, administration and information systems used in the company and learn to understand them in order to solve upcoming tasks. They are directly integrated into practical teams and thus receive essential impulses for the development of new or the consolidation of previously acquired social skills. The students deepen the specialist knowledge acquired in the theoretical modules and apply it in an exemplary manner in operational practice.	1	6

4DE-PM2-20	Practical module 2 "Application of Practical and Problem-solving Techniques "	This practical phase imparts possible applications and functionalities of current hardware and software solutions. Students extend their basic skills in the evaluation of technical documentations in terms of their information content for relevant components and products. Students deepen the specialist knowledge acquired in the theory modules and apply it in an exemplary manner in the paper to be prepared.	2	6
4DE-PM3-30	Practical module 3 „Engineering Work"	This practical phase aims to familiarize students with engineering contexts. Students are able to capture and allocate necessary input information for internal documentation processing. They are also enabled to conceive necessary solutions from the customer's or contractor's point of view and take first steps towards their implementation.	3	6
4DE-PM4-40	Practical module 4 „Independent Engineering Work"	Upon completion of this module, students are able to apply and use specialist skills. They can work scientifically on complex tasks and participate constructively in their solution. Students deal with in-depth problems and discuss them in a written paper.	4	6
4DE-PM5-50	Practical module 5 "Independent Problem Solving"	Taking into account their theoretical training, students independently work on suitable specialist tasks, sub-areas and documentation sections with a focus on their future field of activity. The aim is to integrate the solution into the corporate process, including the analysis of the associated information flows.	5	6
4DE-BT-60	Bachelor Thesis „Digital Engineering"	With the bachelor thesis, students demonstrate their ability to independently work on a practice-relevant problem within a given period of time, to critically evaluate it and develop it further. They are supposed to apply previously acquired practical and theoretical knowledge and scientific methods. The result is to be explained in a presentation.	6	9