Module code	Module title	Module description	Semester	ECTS
Compulsory modules				
4DE-IMAPH-10	Engineering Mathematics / Technical Physics	The module provides students with solid theoretical and practical fundamental knowledge and enables them to solve basic problems in engineering fields such as mechanical engineering, production engineering, and IT. The fundamentals of arithmetic and algebra acquired in secondary education are expanded and the deeper meaning of analysis is developed pragmatically in accordance with the targeted learning objectives of "Digital Engineering". The part "Technical Physics" consolidates basic knowledge of physics and technology and teaches students to re-acquire, grasp and understand this knowledge. Mathematics is viewed as a tool and instrument for this abstract physical modeling. Both disciplines serve the training of the formal description of the environment with its manifold scientific phenomena made up of a few simple basic facts. These methods and procedures of physical description of nature form the basis of engineering sciences. Their knowledge, especially in their basic features, is indispensable for the adequate description and conception of technical systems.	1	8
4DE-ET-12	Electrical Engineering	In this module, students learn to understand and apply elementary electrical engineering as the physical-technical basis of "Digital Engineering". To this end, previous mathematical knowledge that is required for admission is drawn upon in order to provide an abstract algebraic foundation for physical and electrical engineering models. Subsequently, students are familiar with all fundamental and advanced quantities of electrical engineering and relevant circuit symbols, as well as the mode of operation of elementary passive and active basic switching elements. They have acquired the skills necessary for calculating simple linear electrical networks with steady-state, uniform and harmonic excitation, as well as for calculating elementary transient processes. Particular focus is placed on network analysis by means of complex alternating current calculation as a mathematical basis for circumventing the solving of differential equations.	1 and 2	7
4DE-AMA-20	Applied Mathematics	Based on the fundamental knowledge consolidated and broadened in the module "Engineering Mathematics /Technical Physics (4DE-IMAPH-10)" in the 1st semester, this module further deepens this knowledge by focusing on higher mathematics at the tertiary level. Notwithstanding the required diversification, the module aims to provide the mathematical basis for all further subject of the curriculum: From algebraic structures as an elementary "instruction manual" for mathematics, to the construct of differential equations for describing numerous processes from natural science and engineering, to approximation approaches according to Taylor and Fourier for technical functional dependencies. Integral transformations and their discrete variants	2	6

		represent the mathematical basis of today's digital signal processing systems. The analysis of functions with several independent variables fosters further applied basic mathematical understanding. The module includes further important methods of observation and analysis from the fields of statistics and stochastics for the recording of random events, such as those occurring in industrial process metrology.		
4DE-TMFL-10	Engineering Mechanics and Strength of Materials	The module enables students to become familiar with the fundamentals of strength of materials theory. Students are able to apply this knowledge together with the knowledge of engineering mechanics to the functional and economical design of machine parts. They are enabled to practically apply concepts and methods in the field of strength of materials.	1	5
4DE-PROG-10	Fundamentals of Programming Techniques / 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, particular emphasis is placed on the development of an abstracting and object-oriented way of thinking. Practical exercises deepen the theoretical knowledge and train both algorithmization and object-oriented structuring as well as programming techniques.	1	6
4DE-KCxWF	Engineering Design / Cxx Techniques / Materials and Production Engineering	In this module, students learn fundamentals from the fields of mechanical engineering and production engineering. Upon completion of the module, students are able to create a simple design in accordance with the specifications of the task and to lay out, design and calculate selected machine elements. To this end, they acquire spatial imagination and the basic skills required to produce technical drawings as well as an understanding of the design elements. Furthermore, students acquire knowledge of general methods and working techniques of 3D CAD-supported design. Upon completion of the module, they should be able to understand technical drawings and to create, manipulate and visualize three-dimensional CAD models and generate corresponding technical drawings. In the part "Materials and Manufacturing Engineering", students are introduced to the main properties, treatment options and use of different materials, as well as materials testing techniques. They are also enabled to select and use suitable manufacturing processes for company-specific applications.	1 and 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 the subsequent technical realization of simple combinatorial and sequential switching networks. The part on electronics deals with the functionality and description of typical components of analogue electronics. Graduates are enabled to understand, analyze and calculate the functionality of semiconductor components in simple and complex electronic discrete and integrated circuits. This is based on	2 and 3	8

		both the integration of components and electronic circuits into a complex overall system and the understanding of signal acquisition and signal processing.		
4DE-DBN-30	Data Communication / Bus Systems / Network Technology	The module aims to provide students with an in-depth understanding of the problems involved in the transmission of data via computer networks and bus systems. Algorithms and principles from the different layers of the OSI reference model are examined. Practical examples are used to illustrate their application.	3	6
4DE-MANWA-30	Self-Management / Academic Work	Upon completion of the module, students have acquired fundamental knowledge of self-management and time management. They are able to personally reflect on these basic soft skills in an independent way and to plan, coordinate and analyze their personal studying and working style in an even more efficient way. Furthermore, students are familiar with the methodology of academic work and are able to apply this knowledge in their field of study.	3	4
4DE-SYSM-30	System Modeling / Software Engineering	Students are enabled to plan and execute a complex system development process from a technical point of view. To this end, they acquire the core competency of mapping components from the real world to the digital world. Particular focus is placed on the modeling of requirements and applications. Practical computer exercises deepen the understanding of the subject and strengthen practical skills and abilities.	3	5
4DE-DBIDI-34	Databases / Internet Technologies / Data Protection and Information Security	The module part on databases imparts knowledge and skills in the modeling, application and administration of relational database systems. Students take part in practical, tutorials in computer laboratories, where they can test their skills on concrete database products and deepen their knowledge. The module further aims to enable students to classify, evaluate and test current Internet technologies with the goal of critically examining their possible applications in the area of industrial production systems and presenting their own proposals for solutions. Particular importance is attached to the increasing need for protection of the data to be exchanged. This concerns both technical security of increasingly complex systems as well as data protection issues. The course wants to sensitize students for this topic and present the current state of the art. Focus is placed on the mathematical fundamentals of cryptographic methods. They are deepened to the extent necessary to understand the functionality of modern cryptographic algorithms.	3 and 4	12
4DE-RAES-40	Computer Architecture and Embedded Systems	The module enables students to evaluate current computer architecture structures and procedures and to design simple components of a computer system.	4	5

		The fundamental principles of each computer architecture are introduced and consolidated by means of a concrete instruction set architecture. Students are familiarized with the fundamentals, structure, and use of embedded systems in a systematic sequence. Proceeding from basic hardware architectures and system software for time-critical applications, the module covers the signal flow from sensors to electronic components for signal processing and digitization, application software for open-loop and closed-loop control tasks, as well as output to the periphery of the actuator system. Practical computer exercises strengthen practical skills and abilities.		
4DE-ABWL-40	Applied Business Administration	The module imparts the fundamentals and interrelationships of business administration. Proceeding from fundamental terms and tasks of business administration, students are familiarized with (success) goals of companies, the contents of constitutive decision-making processes as well as the management and execution system of companies. They become familiar with important financial ratios and learn how to apply them. In addition, the module provides students with the basic principles of business accounting. They are able to apply selected instruments of cost accounting, investment accounting and cost management in a situational and goal-oriented manner.	4	5
4DE-IP-40	Industrial Processes	Upon completion of the module, students have gained the competencies required for efficient and reliable process design in the context of the digitalized working world. They are familiarized with the knowledge, methods and tools of industrial engineering. Students acquire fundamental knowledge of process and data management in order to create the prerequisites for the digitalized world of work and Industry 4.0.	4	6
4DE-PMQM-45	Project and Quality Management	Students are able to design, manage and successfully complete their own projects and use computer-aided project management systems to complete their tasks. Upon completion of the module, students are also capable of determining product characteristics for quality assurance purposes. The module also aims to provide students with an understanding of the main purpose and structure of a quality management system. Focus is placed on the ISO 9000 family of standards for structuring a QMS.	4 and 5	5
4DE-MSR-50	Measurement and Control Technology	Students learn the fundamentals of measurement and control technology in a systematic sequence, starting from signal and system theoretical abstraction approaches with linear, feedback-free transmission elements to the description of the system behavior in original and image areas to the use of such "finished" devices and functional assemblies in production and manufacturing technology.	5	8

		As part of the section on sensor technology, students are introduced to the principles of transducers for the electrical measurement of non-electrical quantities, including the use of current terminology relating to measurement uncertainty. Focus is laid on the integration of functional units, such as measuring equipment for geometric quantities, into a complex overall system, such as production technology, as well as the understanding of signal acquisition and signal processing as part of measurement and control technology issues. Fundamental knowledge of the hardware and software of industrial controllers provides the basis for the use of control systems. Further module contents include the description of control loops and solution approaches with continuous and discontinuous control systems as well as digital control algorithms.		
4DE-SYSMOB-50	System Software and Mobile Applications	The module imparts fundamental knowledge of the architecture and functional principles of modern operating systems. Students also develop the skills required to independently program mobile applications, taking into account the interfaces and hardware components of the end devices. They gain an overview of different implementation methods and their application scenarios.	5	5
4DE-SICK-50	Language and Intercultural Communication	The module aims to build up professional, communicative, social and intercultural competences. Students are enabled to conduct professional communications in the field of digital engineering on an international level. Upon completion of the module, students are able to describe themselves and their professional and academic context in the foreign language and to deal with everyday communication situations in the professional environment. Students can present their company with its fundamental processes and essential facts in written and oral form, using modern presentation techniques. They are enabled to work in international teams.		
4DE-RMV-56	Robotics and Machine Vision	The module provides basic knowledge for understanding the subject of robotics and industrial image processing and enables students to independently program robots. This includes, among other things, robot-specific coordinate systems and their transformation. Machine Vision is used to teach and train skills and abilities for machine object recognition.	5 and 6	7
4DE-PLDF-60	Production Logistics and Digital Factory	Upon completion of the module, students are able to identify problems and interfaces along the value creation process for the manufacture of products and network them through the use of innovative techniques. Problem-solving strategies to be developed in this context focus on the increasing integration of distributed production processes in and between companies and company networks. With this module, students acquire fundamental knowledge of the analysis and optimization of material flows and the design of logistical processes. Upon completion of the module, students	6	5

		have fundamental theoretical knowledge of planning, designing, and optimizing processes along the value chain.		
4DE-TBPI-60	Technical and Business Process Informatics	Students become familiar with practical problems of enterprise information systems as well as process control engineering and process visualization of production, supply and process engineering plants from companies in the industrial, service and utility sectors. They gain an overview of the structures and functionalities of control engineering solutions from the perspective of process informatics. They are able to recognise data and information flows between different spatially distributed information sources and sinks as well as manual and machine data processing. Students are thus qualified to perform analyses on the origin of information, identify media discontinuities, and create future solution and migration approaches for complex and historically evolved information and data structures. The reference architecture model Industrie4.0 (RAMI4.0) according to DIN SPEC 91345 is used as an abstraction basis. The 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 the needs of the partner companies that arise at short notice. Under the guidance of lecturers, students develop special knowledge , represent this knowledge and participate in professional group discussions in the form of a proseminar. This gives graduates the opportunity to see the practical feasibility and application of nearly all preceding contents from the curriculum of "Digital Engineering". In addition, students can acquire additional qualifications (such as REFA, Ada certificate, language certificates, etc.).	6	7
4DE-RECHT-60	Law	The module provides students with knowledge of the legal basis of their practical and professional occupation and enables them to integrate legal problems with the legal system and to apply relevant legal provisions to solve these problems. For this purpose, the module uses case studies to introduce students to the systematics and application of German private law and the fundamentals of labor law with the specifics of technical, medical and social occupational health and safety. Further protective rights of the individual in the context of their intellectual creations are dealt with in the legal field of industrial property protection. The protection of the environment, which is covered by the environmental protection law (environmental law) as a part of the administrative law, is also taken into account. 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, Administration and IT Processes at the Partner Company	In the first practical phase, students become familiar with their workplace, their partner company and elementary processes and activities. They deal with the production, QM, administration, and IT systems used in the company and learn to understand these systems for the solution of pending 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 competences. Students deepen the professional knowledge gained in the theoretical modules and apply it in an exemplary manner in operational practice.	1	6
4DE-PM2-20	Practical module 2 "Applying Practical and Problem-Solving Techniques".	This practical phase focuses on possible applications and functionalities of existing hardware and software solutions. Students expand their basic skills in evaluating technical documentations with regard to their information content for relevant assemblies and products. Students deepen their specialist knowledge acquired in the theoretical modules and apply it exemplarily in the form of a report.	2	6
4DE-PM3-30	Practical module 3 "Engineering work"	In this practical phase, students are familiarized with engineering contexts. They are able to gather and classify relevant input information for internal documentation processes. Furthermore, they are enabled to develop solutions from the customer's or contractor's perspective and to take the first steps towards their implementation.	3	6
4DE-PM4-40	Practical module 4 "Autonomous Engineering Work"	Upon completion of the module, students can apply and use specialist skills. They are able to collaborate on complex tasks in an academic manner and participate constructively in the solution of tasks. Students handle more detailed problems and prepare a written assignment on their work.	4	6
4DE-PM5-50	Practical Module 5 "Independent Problem Solving"	In this practical phase, students work independently on relevant professional tasks, subareas, and documentations that relate to their future field of work, taking into account the theoretical background they have acquired. Main emphasis is placed on the integration of the solution into the company's process, including the analysis of the related information flows.	5	6
4DE-BT-60	Bachelor’s Thesis „Digital Engineering“	With their bachelor's thesis, students demonstrate their ability to independently work on, critically evaluate, and further develop a practical problem within a specified period of time using the previously acquired practical and theoretical knowledge and academic methods. They are able to present the results in a presentation.	6	9