M.Sc. Digital Health
a) **Mandatory Modules**

HPI-DH-HS: Health Systems and Sciences for Digital Health	Number of credit points (CP): 6
Module type (mandatory or elective):	Mandatory module

Module content and qualification goals:	**Content** This module provides an overview that includes the parties, processes and services involved in selected areas of digital health. It covers both national and international aspects of the field. Students receive an understanding for care objectives and standards, structures, classifications and evaluations in the healthcare field as well as in the sector of research and patient-centered treatment. The primary focus is on the introduction, integration and monitoring of digital solutions. Areas examined in this connection include aspects of the translation of innovative solutions in routine operations, networking (nationally and internationally) and knowledge transfer with the aim of achieving maximum user acceptance. The users under consideration are a diverse group that includes patients, doctors, physicians, researchers, as well as controllers, statisticians, financial accountants, administrators, etc. This module also provides knowledge of innovation management, for example new business models in the healthcare industry. **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students: • acquire discipline-specific theoretical, methodological and practical knowledge in the field of "Health Systems and Sciences for Digital Health" and the ability to contribute this knowledge to developmental processes, • learn to recognize current and future challenges in (e.g.) health care, healthcare research and in clinical processes, • carry out the in-depth investigation of a topic on the basis of primary and secondary literature, • can choose and apply suitable solutions to a given problem, • develop and use suitable sources of information to solve problems independently, • build their professional judgment skills, • gain the ability to self-reflect, document, analyze and evaluate existing structures in Digital Health and to prepare appropriate adaptation proposals.
(Partial) module examinations (number, form, scope):	Exam types: Written exam (90-120 mins.) or oral exam (30-45 mins.)
Self-study time (in hours [h]):	120

Courses (teaching format)	Contact time (in semester hours/week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination (s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture (lecture)	3	-	-	-
Exercise (exercise)	1	-	Exercises (50%)	

Offered:	Winter Semester
Prerequisite for module participation:	None
Department:	Digital Engineering (HPI)

HPI-DH-SW: Software Architectures for Digital Health	Number of credit points (CP): 6
Module type (mandatory or elective):	Mandatory module

Module content and qualification goals:	**Content** This module provides in-depth knowledge for the analysis, interpretation, design and construction of complex digital systems, networked software infrastructures and interoperable applications for digital health. The acquisition of a profound understanding of these areas and the ability to make independent architectural decisions, while considering specific national and international frameworks, are the focus of this module. The module targets concrete concepts and methods of the software development processes for applications in the life sciences. **Qualification goals** Students: ● acquire discipline-specific theoretical and methodological knowledge, ● gain experience in using software systems and tools, ● can select and apply the appropriate solutions and strategies to a given problem, ● design and implement strategies for software systems in the area of digital health with regard to diverse requirements, ● build their professional judgement skills, ● gain experience in the formalization and abstraction of problems.
Module (part) exams (number, type, scope):	Exam types: Written exam (90-120 mins.) or oral exam (30-45 mins.)
Self-study time (in hours (h)):	120

Courses (format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course accompanying module (part) exam(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture (lecture)	3	-	-	-
Exercise (exercise)	1	-	Exercises (50%)	

Frequency of offer:	Winter Semester
Prerequisite:	None
Department:	Digital Engineering (HPI)

HPI-DH-EC: Ethics, Law and Compliance for Digital Health	Number of credit points (CP): 6
Module type (mandatory or elective):	Mandatory module

Module content and qualification goals:	**Content** The collection, processing and analysis of data in the healthcare sector follows strict framework conditions. For instance, the demands on the availability of data for the maintenance and protection of the private sphere stands in constant conflict with the specific challenges in the digital health sector. The module teaches specific requirements that must be observed in the design and implementation of software systems, as well as in the processing and analysis of digital health data. Accordingly, approaches such as Good Clinical Practices and study data are introduced and discussed, as well as those conditions determined by legal requirements (e.g. the eHealth legislation), or recommendations (e.g. by the German Ethics Council). The learning objective targets the navigation of the area of conflict between the availability and the familiarity of data in a legally compliant manner. Furthermore, participants learn to assess the risks involved in the use of health data, to ethically and legally evaluate conflict situations in business and society and to preventively avoid such situations in a legally sound manner. **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students: - acquire discipline-specific theoretical, methodological and practical knowledge, - choose and apply suitable solutions to given ethical and legal questions, - build their professional judgement skills, - address the risks inherent in the collection and use of health information in a qualified manner, - gain experience in the formalization and abstraction of problems, - acquire the ability to independently investigate and evaluate scientific literature in the context of individual topics.
(Partial) module examinations (number, form, scope):	A paper of at least 12 pages or a written exam (90-120 mins.)
Self-study time (in hours (h)):	120

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture (lecture)	4	-	-	-

Offered:	Summer Semester
Prerequisite for module participation:	None
Department:	Digital Engineering (HPI)

HPI-DH-BP: Digital Health Business and Process Transformation	Number of credit points (CP): 6
Module type (mandatory or elective):	Mandatory module

Module content and qualification goals:	**Content** Based on the large number of stakeholders in the healthcare sector, such as hospitals, doctor's practices, health insurance companies and, last but not least, the private citizen, numerous demands are placed on the interaction between all parties involved. Using the required IT systems, infrastructures and applications as its starting point, this module provides an understanding of the modelling of existing and novel digital health processes, as well as their analysis and assessment. The fundamentals of information- and innovation management in the field of digital health are also covered in this module. **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students: • gain an understanding of the challenges of the management of health data and the underlying functions of the stakeholders involved , • acquire discipline-specific theoretical, methodological and practical knowledge in the definition of innovative processes in the digital health field, • master appropriate methods for the modelling and analysis of processes, for example clinical or research processes, • gain experience in using software systems and tools, • learn to select and apply the appropriate solutions and strategies to a given problem, • carry out the in-depth investigation of a topic on the basis of primary and secondary literature, • gain insight into current solutions of industry and research projects and into the current state of research
(Partial) module examinations (number, form, scope):	Exam types: Written exam (90-120 mins.) or oral exam (30-45 mins.)
Self-study time (in hours (h)):	120

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture (lecture)	3	-	-	-
Exercise (exercise)	1	-	Exercises (50%)	

Offered:	Winter Semester
Prerequisite for module participation:	None
Department:	Digital Engineering (HPI)

HPI-DH-PL: Digital Health Project Lab	Number of credit points (CP): 12
Module type (mandatory or elective):	Mandatory module

Module content and qualification goals:	**Content** In the Digital Health Project Lab students work in a group on a selected, research-oriented problem from the topic area of digital health. The problem is analyzed and a solution designed for a sub-area, which is then constructively implemented and scientifically documented. Students gain deep insights thereby into current research work, participate in the development of new solutions and consolidate their scientific work and writing. This module provides in-depth scientific training. The work in the Digital Health Project Lab is divided into project groups of usually at least three members each. Projects carried out in the Digital Health Project Lab are led by authorized examiners. **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students: • acquire discipline-specific theoretical, methodological and practical knowledge, which they apply themselves, • choose and apply suitable solutions and strategies to a given problem, • carry out the independent selection and analysis of primary and secondary literature, • independently access and evaluate scientific literature in the context of individual topics, • gain experience in the formalization and abstraction of problems, • become familiar with and apply the criteria and principles of scientific writing, • learn and carry out project management, • execute conflict-skills training in the team, • engage in teamwork and work-sharing problem solving.
(Partial) module examinations (number, form, scope):	A paper of at least 12 pages together with a presentation of research results (20 min. talk); the implementation involved in the research question is to be covered in the paper
Self-study time (in hours (h)):	240

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Project (project)	8	-	-	-

Offer:	Winter Semester
Prerequisite for module participation:	None
Department	Digital Engineering (HPI)

b) Elective modules
Specialization area: Scalable Computing and Algorithms for Digital Health (SCAD)

<table>
<tr><td colspan="2">HPI-SCAD-C: Scalable Computing and Algorithms for Digital Health – Concepts and Methods</td><td>Number of credit points (CP): 6</td></tr>
<tr><td>Module type (mandatory or elective):</td><td colspan="2">Elective module</td></tr>
<tr><td>Module content and qualification goals:</td><td colspan="2"><u>Content</u>

Fundamental changes have taken place in medicine and healthcare through the advent of digitalization. These have led to a disruptive transformation of today's processes, for example, in care treatment and research. This module imparts an understanding for the underlying technical concepts and innovations at the heart of digitalization (such as those in telemedicine, wearables, big data technologies and cloud computing) and their translation into the daily routine. Above all, the focus is on establishing innovative, high throughput solutions to support the workflows in selected areas of life science. Among the target areas in the module are: clinical care, medical support and pharmaceutical research.
<u>Qualification goals</u>

Students acquire detailed knowledge of the subject matter presented in the module.
Students:
acquire discipline-specific theoretical, methodological and practical knowledge,
gain an understanding of the challenges and opportunities presented by digital applications and systems in special areas of the life sciences, e.g., health care and clinical research,
gain experience in using software systems and tools,
develop and use suitable sources of information to solve problems independently,
learn the latest approaches and challenges from the field of digital health,
get insight into the current solutions, e.g., of industry and research projects, and learn details on the current state of research</td></tr>
<tr><td>(Partial) module examinations (number, form, scope):</td><td colspan="2">Exam types:
Written exam (90-120 mins.) or oral exam (30-45 mins.) or paper (at least 8 pages) together with a presentation of research results (30-45 min. talk)</td></tr>
<tr><td>Self-study time (in hours (h)):</td><td colspan="2">120</td></tr>
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<table>
<tr><td rowspan="2">Courses (teaching format)</td><td rowspan="2">Contact time (in semester hours per week)</td><td colspan="2">Supplementary exam requirements (number, form, scope)</td><td rowspan="2">Course-related (partial) module examination(s) (number, form, scope)</td></tr>
<tr><td>For completion of module</td><td>For admission to module exam</td></tr>
<tr><td>Lecture/seminar (lecture or seminar)</td><td>4</td><td>-</td><td>-</td><td>-</td></tr>
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<table>
<tr><td>Offered:</td><td>Summer Semester</td></tr>
<tr><td>Prerequisite for module participation:</td><td>None</td></tr>
<tr><td>Department:</td><td>Digital Engineering (HPI)</td></tr>
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HPI-SCAD-T: Scalable Computing and Algorithms for Digital Health – Technologies and Tools	Number of credit points (CP): 6
Module type (mandatory or elective):	Elective module

	Content This module teaches techniques and processes of scalable computing in the field of digital health. It covers, for instance, the tools of scalable software development and the programming tools and their application. These techniques and tools will be examined in terms of their capabilities, application-specific usability and practicality for establishing scalable software solutions for digital health. Students use selected techniques and tools themselves to analyze the strengths and weaknesses in the current state of the art, become sensitized for open research problems, and develop their own techniques and tools to solve these research questions. **Qualification goals** Students: • acquire discipline-specific practical and applied knowledge, • build their professional judgement skills, • acquire skills to select and apply the appropriate software techniques and tools, • develop and use suitable sources of information to solve problems independently, • learn to carry out in-depth investigation of a topic on the basis of primary and secondary literature, • are able to track current research trends and integrate them into their work, • can choose and apply suitable concepts and strategies for solving a given problem, • develop new solutions themselves and thereby expand the state of the art.
Module content and qualification goals:	
(Partial) module examinations (number, form, scope):	Exam types: Written exam (90-120 mins.) or oral exam (30-45 mins.) or paper (at least 8 pages) together with a presentation of research results (30-45 min. talk)
Self-study time (in hours (h)):	120

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture/seminar (lecture or seminar)	4	-	-	-

Offered:	Summer Semester
Prerequisite for module participation:	None
Department:	Digital Engineering (HPI)

HPI-SCAD-S: Scalable Computing and Algorithms for Digital Health – Specialization	Number of credit points (CP): 6
Module type (mandatory or elective):	Elective module

Module content and qualification goals:	**Content** This module provides in-depth knowledge of the processes and concepts of scalable computing for digital health. It addresses current research questions and results, identifies weaknesses in the current state of the art and research, and serves in the scientific elaboration of advanced procedures and systems for software development in the health sector. This is done primarily on the basis of one or more concrete application scenarios. By selecting current research questions, students gain insight into the latest techniques and procedures and can specialize themselves accordingly. **Qualification goals** Students: ● acquire discipline-specific theoretical, methodological and practical knowledge, ● can select and apply the appropriate solutions and strategies to a given problem, ● are able to track current research trends and integrate them into their work, ● acquire the ability to independently investigate and evaluate scientific literature in the context of individual topics, ● gain experience in the formalization and abstraction of problems, ● become familiar with the criteria and principles of scientific writing, ● acquire experience presenting/defending their work, ● learn how to carry out the scientific analysis of research questions, ● are able to make a comparative assessment of their own results with related work.
(Partial) module examinations (number, form, scope):	Written exam (90-120 mins.) or oral exam (30-45 mins.) and demonstration of a developed computer program (30 mins.).
Self-study time (in hours (h)):	120

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture/seminar (lecture or seminar)	4	-	-	-

Offered:	Winter Semester
Prerequisite for module participation:	Recommended participation in HPI-SCAD-C or HPI-SCAD-T.
Department:	Digital Engineering (HPI)

Specialization area: Digitalization of Clinical and Research Processes (DICR)

HPI-DICR-C: Digitalization of Clinical and Research Processes – Concepts and Methods	Number of credit points (CP): 6
Module type (mandatory or elective):	Elective module

Module content and qualification goals:	**Content** This module conveys concepts and methods for the digitization of clinical and research processes, which, for example, place very demands on data quality, reproducibility and stability. Students gain insight into existing digital systems and their historical origins and technical approaches. Moreover, the specific requirements for digital processes in clinical and research contexts are covered, as well as what makes them different from those in other IT areas, such as e.g. eCommerce or banking. In this way, students gain an in-depth understanding of the discipline-specific requirements of digitalization. **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students: ● acquire discipline-specific theoretical, methodological and practical knowledge, ● understand and can explain concepts of the digitization of medical processes, ● can assess and compare different methods of digitization based on their effectiveness and applicability, ● can choose and apply suitable concepts and strategies for solving a given problem, ● expand their learning skills.
(Partial) module examinations (number, form, scope):	Exam types: Written exam (90-120 mins.) or oral exam (30-45 mins.) or paper (at least 8 pages) together with the presentation of research results (30-45 min. talk)
Self-study time (in hours (h)):	120

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture/seminar (lecture or seminar)	4	-	-	-

Offered:	Summer Semester
Prerequisite for module participation:	None
Department:	Digital Engineering (HPI)

HPI-DICR-T: Digitalization of Clinical and Research Processes – Technologies and Tools	Number of credit points (CP): 6
Module type (mandatory or elective):	Elective module

Module content and qualification goals:	**Content** This module imparts in-depth practical knowledge. With the help of common techniques and tools, digital processes and systems are examined in clinical and research contexts using concrete, practical examples. The module deals with, for example, the techniques and tools for the procedure of event processing and analysis. Also examined are tools for software and main memory databases and methods for information integration and interoperability with the focus on digital health. Students analyze strengths and weaknesses in the current state of technology, become sensitized to open research problems, and develop their own techniques and tools to solve these research questions. **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students: ● acquire discipline-specific theoretical, methodological and practical knowledge, ● gain an overview of the available techniques and tools and learn how to evaluate them, ● acquire the ability to use common software tools, ● become empowered to independently investigate unsolved research problems and to develop solutions for them, ● choose and apply suitable solutions to a given problem, ● build their professional judgement skills, ● expand their learning skills.
(Partial) module examinations (number, form, scope):	Exam types: Written exam (90-120 mins.) or oral exam (30-45 mins.) or paper (at least. 8 pages) together with the presentation of research results (30-45 min. talk)
Self-study time (in hours (h)):	120

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture/seminar (lecture or seminar)	4	-	-	-

Offered:	Summer Semester
Prerequisite for module participation:	None
Department:	Digital Engineering (HPI)

HPI-DICR-S: Digitalization of Clinical and Research Processes – Specialization		Number of credit points (CP): 6
Module type (mandatory or elective):	Elective module	

Module content and qualification goals:	**Content** This module provides current research issues and results that contribute to an understanding of the requirements and risks involved in the digitization of clinical processes and its related research. The module focuses on the identification of weaknesses and open questions in the current state of research, as well as the scientific development of advanced methods and systems. National and international approaches are compared and evaluated. The module further provides an understanding of the possibilities and challenges of personalized medicine and patient-centered health care as well as evidence-based research projects. **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students: ● acquire discipline-specific theoretical and practical knowledge, ● learn to independently carry out the in-depth investigation of a topic on the basis of primary and secondary literature, ● acquire the ability to independently identify relevant literature, express its meaning and apply its contents, ● learn to present and critically discuss executed tasks, ● expand their learning skills, ● develop their discussion skills and techniques, ● learn the scientific analysis of current research questions, ● can independently evaluate and classify existing research approaches.

(Partial) module examinations (number, form, scope):	Written exam (90-120 mins.) or oral exam (30-45 mins.) and demonstration of a developed computer program (30 mins.)
Self-study time (in hours (h)):	120

Courses (teaching format)	Contact time (in semester hour per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture/seminar (lecture or seminar)	4	-	-	-

Offered:	Winter Semester
Prerequisite for module participation:	Recommended participation in HPI-DICR-C or HPI-DICR-T.
Department:	Digital Engineering (HPI)

Specialization area: Acquisition, Processing and Analysis of Health Data (APAD)

HPI-APAD-C: Acquisition, Processing and Analysis of Health Data – Concepts and Methods		Number of credit points (CP): 6
Module type (mandatory or elective):	Elective module	
Module content and qualification goals:	**Content** The focus of this specialization area is on the entire process chain—from collecting and processing to analyzing and evaluating specific digital health data. Concepts and methods are taught for the handling of: big data from heterogeneous data sources (variety); data with high acquisition frequency and fast processing times (velocity); and extensive data sets (volume). Examined in this context will be practically-oriented procedures of data integration (e.g. extract transform load), harmonization (e.g. interoperability standards and terminologies) for the processing (e.g. automated data processing pipelines) and analyzing (e.g. data exploration, machine learning) of data. **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students: ● acquire discipline-specific, theoretical and practical knowledge, ● choose and apply suitable concepts and strategies to solve a given problem, ● build their professional judgement skills, ● develop and use suitable information sources to solve problems independently, ● become familiar with basic procedures of data integration, ● can evaluate strategies for data processing to address different requirements, ● learn to recognize complex problems of data acquisitions and to subsequently define appropriate solution strategies, ● get an overview of the discipline-specific procedures of data analysis, ● expand their learning abilities.	
(Partial) module examinations (number, form, scope):	Exam types: Written exam (90-120 mins.) or oral exam (30-45 Min.) or paper (at least 8 pages) together with the presentation of research results (30-45 min. talk)	
Self-study time (in hours (h)):	120	

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture/seminar (lecture or seminar)	4	-	-	-

Offered:	Summer Semester
Prerequisite for module participation:	None
Department:	Digital Engineering (HPI)

HPI-APAD-T: Acquisition, Processing and Analysis of Health Data – Technologies and Tools	Number of credit points (CP): 6
Module type (mandatory or elective):	Elective module

Module content and qualification goals:	**Content** This module covers techniques and tools for the development of inhomogeneous data sources for data-driven, digital health systems. The focus will be on machine-learning procedures, probability models and concrete data-exploration techniques that serve in the analysis of complex digital health data. Techniques and tools will be examined for, among other things, their capabilities, application-specific usefulness and practicability. In this connection, the concrete implementation of important technologies for addressing the problems of data collection, processing, integration, transformation and analysis in digital health will be exemplified. **Qualifications goals** Students acquire detailed knowledge of the subject matter presented in the module. Students: ● acquire discipline-specific, practical and applied knowledge, ● can choose and apply suitable concepts and strategies in solving a given problem, ● build their professional judgement skills, ● develop and use suitable sources of information to solve problems independently, ● can implement strategies of data processing for various digital health requirements, ● learn to select suitable tools for subject-specific questions, ● gain an overview of the available techniques and tools and learn to apply them, ● get tangible insight into the entire data processing chain, ● expand their learning skills.
(Partial) module examinations (number, form, scope):	Exam types: Written exam (90-120 mins.) or oral exam (30-45 mins.) or paper (at least 8 pages) together with a presentation of research results (30-45 mins. talk)
Self-study time (in hours (h)):	120

Courses (format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture/seminar (lecture or seminar)	4	-	-	-

Offered:	Summer Semester
Prerequisite for module participation:	
Department:	Digital Engineering (HPI)

HPI-APAD-S: Acquisition, Processing and Analysis of Health Data – Specialization	Number of credit points (CP): 6
Module type (mandatory or elective):	Elective module

Module content and qualification goals:	**Content** This module addresses current research questions and results on selected aspects of the acquisition, processing and analysis of digital health data. The module focuses on specific topics and questions in order to identify current trends and novel procedures—as well as the weaknesses of existing approaches. In addition, it concentrates on the scientific development of advanced methods and systems for data acquisition, processing, integration, transformation, and analysis in the area of digital health. Besides clinical applications, selected questions from neighboring life science fields are in the forefront. The multidisciplinary development of practicable solutions is particularly targeted. **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students: ● acquire discipline-specific, theoretical and methodological knowledge, ● learn to independently carry out the in-depth investigation of a topic on the basis of primary and secondary literature, ● acquire experience dealing with software systems and tools, ● gain experience in presenting/defending their work, ● obtain in-depth and precise insights into the practical application of state-of-the-art data processing technologies and systems, ● expand their learning skills, ● develop discussion skills and techniques, ● learn the scientific analysis of current research issues, ● learn to use selected techniques and tools.
(Partial) module examinations (number, form, scope):	Written exam (90-120 mins.) or oral exam (30-45 mins.) and demonstration of a developed computer program (30 mins.).
Self-study time (in hours (h)):	120

Course (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture/seminar (lecture or seminar)	4	-	-	-

Offered:	Winter Semester
Prerequisite for module participation:	Recommended participation in HPI-APAD-C or HPI-APAD-T.
Department:	Digital Engineering (HPI)

Specialization area: Health Data Security (HDAS)

HPI-HDAS-C: Health Data Security – Concepts and Methods	Number of credit points (CP): 6
Module type (mandatory or elective):	Elective module

Module content and qualification goals:	**Content** The use of digital health data places great demands on security and is subject to strict legal frameworks. This module provides concepts and methods for the appropriate handling of health data. In the module, selected, security relevant aspects are examined, such as IT security, data protection and data security. The emphasis in the module is placed on the conceptual and methodological foundations of the same areas, for instance the theory of modern encryption procedures or concepts for anonymization and pseudo-anonymization, as well as on technical and organizational data protection. Basic methods such as those pertaining to big data security or threat and vulnerability are also covered. **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students: ● acquire discipline-specific theoretical and methodological knowledge, ● choose and apply suitable concepts and strategies to solve a given problem, ● become familiar with selected procedures for the protection of health data, ● can evaluate and classify security concepts for various requirements in the digital health sector, ● build their professional judgement skills, ● develop and use suitable sources of information to solve problems independently, ● learn to recognize complex security aspects and are able to implement countermeasures, ● expand their learning skills.
(Partial) module examinations (number, form, scope):	Exam types: Written exam (90-120 mins.) or oral exam (30-45 mins.) or paper (at least 8 pages) together with a presentation of research results (30-45 min. talk)
Self-study time (in hours (h)):	120

		Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
Courses (teaching format)	Contact time (in semester hours per week)	For completion of module	For admission to module exam	
Lecture/seminar (lecture or seminar)	4	-	-	-

Offered:	Winter Semester
Prerequisite for module participation:	None
Department:	Digital Engineering (HPI)

HPI-HDAS-T: Health Data Security – Technologies and Tools	Number of credit points (CP): 6
Module type (mandatory or elective module):	Elective module

Module content and qualification goals:	**Content** This module provides techniques and tools for the secure handling of health data in the context of digital health application cases. The areas examined thereby include aspects of data collection and the data processing of health data and measures for the protection of the same. For example, techniques and tools related to health data are discussed and the possible risks associated with combining such data (e.g. in big data analysis) addressed. In the forefront are concepts and concrete techniques on topics such as data locality, anonymization, federal information exchange and access control procedures as well as aspects of the secure, high throughput processing of data in the context of practice-oriented examples. **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students: ● acquire discipline-specific theoretical and methodological knowledge, ● choose and apply suitable concepts and strategies to solve a given problem, ● are able to reflectively identify weak points in complex software systems and to address them with appropriate countermeasures, ● are trained in the handling of health data, ● become familiar with the individual characteristics of sensitive data, ● can apply methods and techniques to protect individual data, ● expand their professional judgement skills, ● develop and use suitable sources of information to solve problems independently, ● can implement security concepts for various healthcare requirements, ● gain an overview of the available techniques and tools and learn to evaluate them.
(Partial) module examinations (number, form, scope):	Exam forms: Written exam (90-120 mins.) or oral exam (30-45 mins.) or paper (at least 8 pages) together with the presentation of research results (30-45 min. talk)
Self-study time (in hours (h)):	120

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture/seminar (lecture or seminar)	4	-	-	-

Offered:	Summer Semester
Prerequisite for module participation:	None
Department:	Digital Engineering (HPI)

HPI-HDAS-S: Health Data Security – Specialization	Number of credit points (CP): 6
Module type (mandatory or elective):	Elective module

Module content and qualification goals:	**Content** This module offers current research questions and results in the specialization area. Concrete measures and the latest research results are discussed from areas including IT security, data protection and data security. The module's focus is on identifying weaknesses in current research and on the scientific development of advanced processes, such as comprehensive identity management, attack vector analysis, cryptologic procedures and quantum cryptography and the security of wearables and sensors. Attention is also given to questions concerning the security of complex scalable software systems. **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students: ● acquire discipline-specific theoretical and methodological knowledge, ● are able to independently identify risks when dealing with sensitive data and to work out solutions, ● learn to independently carry out in-depth investigation of a topic on the basis of primary and secondary literature, ● gain experience in the use of software systems and tools, ● expand their learning skills, ● acquire experience presenting/defending their work, ● obtain in-depth and precise insights into the practical application of state-of-the art IT security systems, ● develop discussion skills and techniques, ● learn the scientific analysis of current research questions.
(Partial) module examinations (number, form, scope):	Written exam (90-120 mins.) or oral exam (30-45 mins.) and demonstration of a developed computer program (30 mins.)
Self-study time (in hours (h)):	120

Courses (teaching formats)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture/seminar (lecture or seminar)	4	-	-	-

Offered:	Winter Semester
Prerequisite for module participation:	Recommended participation in HPI-HDAS-C or HPI-HDAS-T.
Department:	Digital Engineering (HPI)

Bridge module: Principles of IT Systems (DHBM-IT)

HPI-DHBM-IT: Principles of IT Systems	Number of credit points (CP): 6
Module type (mandatory or elective module):	Mandatory module, depending on determination of the Examination Board in the context of admission to the program (cf. §4 of the Entry and Admissions Regulations)
Module content and qualification goals:	**Content** This bridge module provides basic concepts and technologies of complex IT systems and the Internet/WWW as required in the digital health field. **Qualification goals** Students acquire a broad knowledge of IT systems and of the subject-specific matters taught in the module. Students: • acquire discipline-specific theoretical, methodological and practical knowledge, • learn to independently carry out in-depth investigation of a topic on the basis of primary and secondary literature, • acquire the ability to independently investigate and evaluate scientific literature in the context of individual topics, • learn and practice basic academic skills.
(Partial) module examinations (number, form, scope):	Exam types: Written exam (90 mins.) or oral exam (30 mins.)
Self-study time (in hours (h)):	120

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture/seminar (lecture or seminar)	4	-	-	-

Offered:	Winter Semester
Prerequisite for module participation:	Determined by the Examination Board upon admission to the program
Department:	Digital Engineering (HPI)

Bridge module: Fundamentals of Programming (DHBM-PR)

HPI-DHBM-PR: Fundamentals of Programming	Number of credit points (CP): 6
Module type (mandatory or elective):	Mandatory module, depending on determination of the Examination Board in the context of admission to the program (cf. §4 of the Entry and Admissions Regulations)

Module content and qualification goals:	**Content** This bridge module provides a basic knowledge of programming languages, development tools, strategies, and selected aspects pertaining to the programming of complex software systems as required in the digital health field. **Qualification goals** Students acquire basic knowledge of programming methods, tools and languages. Students: • acquire discipline-specific theoretical, methodological and practical knowledge, • learn to carry out independent follow-up work on a topic based on primary and secondary literature, • gain the ability to independently investigate and evaluate scientific literature in the context of individual topics, • learn and practice basic academic skills.
(Partial) module examinations (number, form, scope):	Exam types: Written exam (90 mins.) or oral exam (30 mins.)
Self-study time (in hours (h)):	120

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture/seminar (lecture or seminar)	4	-	-	-

Offered:	Winter Semester
Prerequisite for module participation:	Determined by the Examination Board upon admission to the program
Department:	Digital Engineering (HPI)

Bridge module: Introduction to Principles in Medicine (DHBM-PM)

HPI-DHBM-LS: Introduction to Principles in Medicine	Number of credit points (CP): 6
Module type (mandatory or elective):	Mandatory module, depending on determination of the Examination Board in the context of admission to the program (cf. §4 of the Entry and Admissions Regulations)

Module content and qualification goals:	**Content** This bridge module teaches selected foundations and concepts from various areas of medicine and those competencies required for medical documentation that are necessary in understanding and handling digital health issues. **Qualification goals** Students acquire a broad background knowledge of life science fundamentals. Students • acquire discipline-specific theoretical and methodological knowledge, • learn to carry out independent follow-up work on a topic on the basis of primary and secondary literature, • are able to independently access and evaluate scientific literature in the context of individual topics, • learn and practice academic skills.
(Partial) module examinations (number, form, scope):	Exam types: Written exam (90 mins.) or oral exam (30 min.)
Self-study time (in hours (h)):	120

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture/seminar (lecture or seminar)	4	-	-	-

Offered:	Winter Semester
Prerequisite for module participation:	Determined by the Examination Board upon admission to the program
Department:	Digital Engineering (HPI)

Bridge module: Fundamentals of Healthcare Systems (DHBM-HS)

HPI-DHBM-HS: Fundamentals of Healthcare Systems	Number of credit points (CP): 6
Module type (mandatory or elective module):	Mandatory module, depending on determination of the Examination Board in the context of admission to the program (cf. §4 of the Entry and Admissions Regulations)

Module content and qualification goals:	**Content** This bridge module provides a basic knowledge of the international health system and the specifications and characteristics necessary in the area of digital health. **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students: • acquire discipline-specific theoretical, methodological and practical knowledge, • learn to independently carry out the in-depth investigation of a topic on the basis of primary and secondary literature, • acquire the ability to independently investigate and evaluate scientific literature in the context of individual topics, • learn and practice academic skills.
(Partial) module examinations (number, form, scope):	Exam types: Written exam (90 mins.) or oral exam (30 mins.)
Self-study time (in hours (h)):	120

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Lecture/seminar (lecture or seminar)	4	-	-	-

Offered:	Winter Semester
Prerequisite for module participation:	Determined by the Examination Board upon admission to the program
Department:	Digital Engineering (HPI)

Soft Skills

HPI-SSKDTA: Design Thinking Advanced	Number of credit points (CP): 6
Module type (mandatory or elective):	Elective module

Module content and qualification goals:	**Content** This module deepens the Design Thinking concept and focuses on the introduction and application of new methods from the fields of design, development and implementation. The Design Thinking process combines methods and instruments from design, engineering and business. The approach uses methods and instruments to understand what the latent wishes and needs of customers will be. This user-orientation is combined with the perspective of technological feasibility and economic viability. In this module, the techniques are applied to a concrete problem faced by the project partner (large or medium-sized company, public institution, non-profit organizations). In the course of the method, several iterations of the Design Thinking process are carried out to develop innovative problem solutions for the identified activity fields (product, service/interaction or business model design) and to describe innovation approaches. **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students: • acquire discipline-specific theoretical and methodological knowledge, • develop and tap into their creativity, • acquire experience presenting/defending their work, • learn how to responsibly handle delineated tasks in group work, • learn how to collaborate in teams and tackle complex problems with divided responsibilities, • practice teamwork and work-sharing in solving problems, • practice conflict resolution skills in a team, • learn leadership skills, • gain experience in assuming responsibility.
(Partial) module examinations (number, form, scope):	Project documentation (15 pages)
Self-study time (in hours (h)):	120

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Project seminar (seminar)	4	-	Presentations (3x, 15 mins. ea.)	-

Offered:	Every semester
Prerequisite for module participation:	Recommended participation in HPI-SSKDTB
Department:	Digital Engineering (HPI)

HPI-SSKDTB: Design Thinking Basics	Number of credit points (CP): 6
Module type (mandatory or elective):	Elective module

Module content and qualification goals:	**Content** This module teaches the principles, techniques and procedures of Design Thinking—a user-centered innovation approach. The Design Thinking process combines methods and instruments from the areas of design, engineering and business. The approach uses methods and instruments to identify the latent wishes and needs of future customers. This user-orientation is combined with the perspective of technological feasibility and economic viability. The Design Thinking Basics module provides an introduction to the topic in the form of several smaller Design Thinking projects (a 3-week and a 6-week project). **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students - acquire discipline-specific theoretical and methodological knowledge, - can develop and tap into their creativity, - acquire experience presenting/defending their work, - learn how to responsibly handle delineated tasks in group work, - learn how to collaborate in teams and tackle complex problems with divided responsibilities, - practice teamwork and work-sharing in solving problems, - practice conflict resolution skills in a team, - learn leadership skills, - gain experience in assuming responsibility.
(Partial) module examinations (number, form, scope):	Project documentation (15 pages)
Self-study time (in hours (h)):	120

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For the completion of module	For admission to module exam	
Project seminar (seminar)	4	-	Presentations (3x, 15 mins. ea.)	-

Offered:	Every semester
Prerequisite for module participation:	None
Department:	Digital Engineering (HPI)

HPI-SSK-CO: Communication Skills	Number of credit points (CP): 6
Module type (mandatory or elective):	Elective module

Module content and qualification goals:	**Content** This module teaches different types of communication skills that play an important role in IT systems engineering. For example, different aspects of preparing and executing presentations are discussed. Students learn moderation techniques and practice conflict management skills. **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students - acquire discipline-specific theoretical and methodological knowledge, - can select and apply the appropriate solutions and strategies to a given problem, - get an opportunity to perform self-assessment, - can develop and tap into their creativity, - practice communication skills, - practice teamwork and work-sharing in solving problems, - practice conflict resolution skills in a team, - learn leadership skills, - gain experience in assuming responsibility.
(Partial) module examinations (number, form, scope):	Talk (30-45 mins.) with documentation (8 pages)
Self-study time (in hours (h)):	120

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Project seminar (seminar)	4	-	Active participation in teams in different roles	-

Offered:	Every semester
Prerequisite for module participation:	None
Department:	Digital Engineering (HPI)

HPI-SSK-MLE: Management and Leadership	Number of credit points (CP): 6

Module type (mandatory or elective):	Elective module
Module content and qualification goals:	**Content** This module provides key competencies with regard to positions in management and leadership. The module includes offers in method expertise, decision-making competence, social skills and self-competence. **Qualification goals** Students acquire detailed knowledge of the subject matter presented in the module. Students ● acquire discipline-specific theoretical and methodological knowledge, ● can develop and tap into their creativity, ● acquire experience presenting/defending their work, ● learn how to responsibly handle delineated tasks in group work, ● practice communication skills, ● practice teamwork and work-sharing in solving problems, ● practice conflict resolution skills in a team, ● learn leadership skills, ● gain experience in assuming responsibility.
(Partial) module examinations (number, form, scope): Self-study time (in hours (h)):	Talk (30-45 mins.) with documentation (8 pages) 120

Courses (teaching format)	Contact time (in semester hours per week)	Supplementary exam requirements (number, form, scope)		Course-related (partial) module examination(s) (number, form, scope)
		For completion of module	For admission to module exam	
Project seminar (seminar)	4	-		-

Offered:	Every semester
Prerequisite for module participation:	None
Department:	Digital Engineering (HPI)