Module catalog Master of Science Computer Science planned start: Winter semester 2024/2025 - in progress -

HPI-CS-AAC: Applied Algorithms - Core			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	 Content: The subject of this module is the concrete and efficient implementation of algorithms. In particular, it is about the creative solution to problems in the area of algorithms and then the subsequent implementation as a computer program. Various topics from the areas of graph algorithms, string algorithms, algorithmic number theory or related areas are covered. Qualification goals: Students acquire detailed knowledge of the specialized topic covered in the module. Students: become familiar with techniques and libraries for the efficient implementation of algorithms as computer programs; Can analyze a complex, linguistic problem and convert it into a formal problem; are able to span the entire spectrum from problem description to executable code; can solve algorithmic problems creatively; are able to translate algorithms into efficient code in a short time. 			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins. Oral exam. 30-45 mins.			
Self-study time (in hours [h]):	120			
				-
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
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Frequency of offer:		WiSe and SoSe		
Prerequisite:		None Digital Engineering		

HPI-CS-AAD: Applied Algorithm	ns - Deep Dive		Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: The subject of this in-depth module is the concrete and efficient implementation of algorithms. In particular, it is about the creative solution of advanced problems in the field of algorithms and subsequent implementation as a computer program. Various advanced topics from the areas of graph algorithms, string algorithms, algorithmic number theory or related areas are covered. Qualification goals: Students acquire detailed knowledge of the specialist topics covered in the module. Students: - become familiar with advanced techniques and libraries for the efficient implementation of algorithms as computer programs; - can analyze a complex, linguistic problem and convert it into a formal problem; - are able to span the entire spectrum from complex problem descriptions to executable code; - can creatively solve advanced algorithmic problems; - are able to translate complex algorithms into efficient code in a short time.			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins. Oral exam, 30-45 mins.			
Self-study time	120			
Courses (teaching format)	Contact time (in semester	Supplementary ex (number, form, scop	am requirements be)	Course accompanying module (partial) exam (s)
	hours)	module	module exam	(number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
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Prequency of offer:		WiSe and SoSe		acommandad
Department:		Digital Engineering	<u>и прі-сэ-аас 18 ř</u>	ecommended.

HPI-CS-AAS: Applied Algorithm	ıs - Specialization		Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: The subject of this in-depth module is the concrete and efficient implementation of algorithms. In particular, it is about the creative solution of advanced problems in the field of algorithms and subsequent implementation as a computer program. Various advanced topics from the areas of graph algorithms, string algorithms, algorithmic number theory or related areas are covered. Qualification goals: Students acquire detailed knowledge of the specialist topics covered in the module. Students: - become familiar with advanced techniques and libraries for the efficient implementation of algorithms as computer programs; - can analyze a complex, linguistic problem and convert it into a formal problem; - are able to span the entire spectrum from complex problem descriptions to executable code; - can creatively solve advanced algorithmic problems; - are able to translate complex algorithms into efficient code in a short time.			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins. Oral exam, 30-45 mins.			
Self-study time	120			
Courses (teaching format)	Contact time (in semester	Supplementary ex (number, form, scop	am requirements	Course accompanying module (partial) exam (s)
	hours)	module	module exam	(number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
		Wige and gege		
Prerequisite:		Wise and Sose	n HPLCS AAC is r	ecommended
Department:		Digital Engineering	11111-05-AAC 1810	

HPI-CS-ADC: Advanced Data Systems - Core			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: Data processing sy (e.g., production, medicine, trade, disciplines. The ur methods for stori structures and ac- limitations. Buildi discussed. This m using intelligent a different types, ar Access and query hardware-related of Qualification goal Students: - learn scalable da - gain knowledge - learn implementa - expand their prof -gain the ability information to sol- - learn how to indel literature; - gain experience	ystems are an essenti industry, service), in infrastructure, comm derlying information ng and retrieving da cess methods with t ing on this, concepts addule also deals wit lgorithms on the data d efficient algorithm methods can be fur optimization. s: ta structures and acce of intelligent query pr ation concepts and alg fessional judgment sk to independently a ve problems; ependently work on a	al component in all n many application nunication, and in systems require effi ata. This module to heir advantages, d of scalable inform h the efficient proc a. The requests are us are discussed for ther improved, for ss methods; rocessing; gorithms; ills; eccess and use su topic based on prim	economic sectors s, for example in a many scientific cient concepts and eaches basic data isadvantages, and ation systems are cessing of queries characterized into processing them. example, through itable sources of ary and secondary oblems.
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins.			
Self-study time	120			
(in nours [n]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form,
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
Frequency of offer:		WiSe and SoSe		
Prerequisite:		None		
Department:		Digital Engineering		

HPI-CS-ADD: Advanced Data Systems - Deep Div		, ,	Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ive module		
Content and qualification goals of the module:	 Content: The module provides in-depth practical knowledge of scalable data systems using common software tools. Classic access methods and query algorithms are compared with the current state of the art. The limits of classic techniques are thus shown and the limitations of the current state of the art also examined. Students are made aware of open problems and are instructed in developing their own solutions to these open research questions. Qualification goals: Students: learn the practical mastery of data systems; can assess the differences between classic access methods and query algorithms and the current state of the art; acquire the ability to independently access and use suitable sources of information to solve problems; learn how to independently carry out the in-depth investigation of a topic based on primary and secondary literature; are able to follow current research trends and incorporate them into their work; can select and apply suitable solution concepts and strategies to a given problem. 			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins. Oral exam 30-45 mins			
Self-study time	120			
(in hours [h]):				
	Contact time	Supplementary ex (number, form, scop	am requirements be)	Course accompanying
Courses (teaching format)	(in semester hours)	For completion of module	For admission to module exam	module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
		-		
Frequency of offer:		WiSe and SoSe		1 1
Prerequisite:		Prior participation II	n HPI-CS-ADC 1s r	ecommended.
		Digital Elignicer llig		

HPI-CS-ADS: Advanced Data Systems - Specializa		tion	Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: This module addre context of scalable weaknesses in the related, specialized primarily done usi Qualification goal Students: - work on develop data systems; - deal with new technologies; - learn how to scie area of scalable da - gain subject-spec - can select and a specialized proble - learn to follow c their work; - are able to inc individual topics; - gain experience i	esses current, in-depthe data systems. It parti- current state of the d techniques for effici- ng one or more specifies ing limitations and ex- advanced data proce- ntifically process curr- ta systems; effic theoretical, meth pply suitable solution m; urrent, advanced rese- lependently access a in the formalization and ria and principles of s	n research questions cularly deals with the art and the scientific ent access and quer fic, advanced applic attensions of existing essing methods, su cent, in-depth research odological and prace n concepts and strate arch trends and incom- and evaluate scient and abstraction of in- scientific writing;	a and results in the ne identification of ic development of y methods. This is ation scenarios. c scalable complex ic as in-memory ch questions in the tical knowledge, tegies to a given, orporate them into tific literature on -depth problems;
Partial module exams (number, form, scope):	 learn methods for presenting and defending completed tasks. Exam types: Paper of at least 8 pages, together with a presentation of research results (20-45 mins.) Written exam, 90-120 mins. 			
Self-study time	120			
(in hours [h]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
		1		
Frequency of offer:		WiSe and SoSe		
Prerequisite:		Prior participation in	n HPI-CS-ADC is re	ecommended.
Department: Digital Engineering		Digital Engineering		

HPI-CS-AIC: AI Applications - Core			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: Artificial intellige and is increasingly and concepts in a processing (NLP) practical knowled various forms of Students gain ex systems as well as an in-depth under strengths and weal and risks in the understanding of r Qualification goals Students: - learn the practica - acquire the abil information to solv - learn how to inc based on primary a - learn to follow cu - are able to selecc given problem.	nce (AI) has opened y shaping everyday li applications, such as or digital health. S ge in the developmen machine learning of perience in designi s in modeling domain rstanding of various knesses—as well as p e context of speci- nethods is deepened i s: al mastery of artificial ility to assess the algorithms; lity to independently ve problems; lependently carry out and secondary literatu urrent research trends et and apply suitable	up a wide range of fe. This module cov s computer vision, tudents acquire bo t of AI systems; for or suitable optimiz ng application-spe n-specific data. This AI paradigms wit otential ethical or se fic AI application in the lecture by pra intelligence method differences betwee access and use su the in-depth investire; and incorporate the solution concepts a	f new applications vers AI techniques natural language th theoretical and example, through zation algorithms. cific models and s module provides th regard to their ocial opportunities us. The practical ctical exercises. ds; en various model uitable sources of tigation of a topic em into their work; and strategies to a
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins. Oral exam, 30-45 mins			search results (20-
Self-study time	120			
(in hours [h]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at	-
(lecture or seminar)			least 50%)	
Frequency of offer:		WiSe and SoSe		
Prerequisite:		None		
Department:		Digital Engineering		

HPI-CS-AID: AI Applications - I	Deep Dive		Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: Artificial intellige and is increasingly and concepts in a processing (NLP) practical knowled various forms of Students gain ex systems as well as an in-depth under strengths and weal and risks in the understanding of r Qualification goals Students: - learn the practica - acquire the ab architectures and a - can independent problems; - learn how to ind based on primary a - learn to follow et - can select and a	nce (AI) has opened y shaping everyday li applications, such as or digital health. S ge in the developmen machine learning of perience in designing in modeling domain rstanding of various cnesses—as well as p e context of specifi nethods is deepened i s: al mastery of artificial ility to assess the algorithms; ly access and use sui dependently carry out and secondary literatu arrent research trends apply suitable solution	up a wide range of fe. This module cov s computer vision, tudents acquire bo t of AI systems; for or suitable optimiz ng application-spe n-specific data. This AI paradigms wit otential ethical or se fic AI application n the lecture by pra intelligence metho differences betwee table sources of inf t the in-depth inves irre; and incorporate the n concepts and stra	f new applications vers AI techniques natural language th theoretical and example, through zation algorithms. cific models and s module provides th regard to their ocial opportunities ns. The practical ctical exercises. ds; en various model formation to solve tigation of a topic em into their work; ategies to a given
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins.			search results (20-
Self-study time	120			
(in nours [h]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at	-
(lecture or seminar)			least 50%)	
Frequency of offer		WiSe and SoSe		
Prerequisite:		Prior participation in HPLCS_AIC is recommended		
Department:		Digital Engineering		

HPI-CS-AIS: AI Applications - Specialization			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: Artificial intellige and is increasingly and concepts in a processing (NLP) practical knowledg various forms of Students gain ex systems as well as an in-depth under strengths and weal and risks in the understanding of r Qualification goal Students: - learn the practica - acquire the ab architectures and a - can independent problems; - learn how to ind based on primary a - learn to follow cr - can select and a problem.	nce (AI) has opened y shaping everyday lit applications, such as or digital health. S ge in the developmen machine learning of perience in designing in modeling domain rstanding of various cnesses—as well as p e context of specific nethods is deepened i s: al mastery of artificial ility to assess the algorithms; ly access and use sui dependently carry out and secondary literatu arrent research trends apply suitable solution	up a wide range of fe. This module cov s computer vision, tudents acquire bo t of AI systems; for or suitable optimiz ng application-speci- n-specific data. This AI paradigms wite otential ethical or se fic AI application n the lecture by pra intelligence method differences between table sources of inf the in-depth investor; and incorporate the n concepts and stra	f new applications vers AI techniques natural language th theoretical and example, through zation algorithms. cific models and s module provides th regard to their ocial opportunities ns. The practical ctical exercises. ds; en various model formation to solve tigation of a topic em into their work; ategies to a given
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins.			search results (20-
Self-study time	120			
(in nours [n]).				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop) For completion of module	am requirements be) For admission to	Course accompanying module (partial) exam (s) (number, form,
			moune enum	scope)
Project seminar/seminar/ lecture	4	-	Exercises (at least 50%)	-
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Frequency of offer:		WiSe and SoSe		
Prerequisite:		Prior participation in	n HPI-CS-AIC is re	commended.
Department:		Digital Engineering		

HPI-CS-ALG: Algorithmics	Number of credit points (CP): 6
Module type (compulsory or compulsory elective module):	Compulsory module/ compulsory elective module
Content and qualification goals of the module:	Content: This module covers algorithm design and algorithm analysis in various areas. As part of these considerations, appropriate data structures are presented and analyzed. Focus topics include graph problems (e.g., path problems, flows), geometric problems (e.g., embeddings) or string problems (e.g., string matching algorithms). The core is mathematical analysis and formal proofs. Concrete proof strategies are presented and deepened. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - familiarize themselves with various algorithms for classical problems and their analyses; - understand in detail the advantages and disadvantages of different algorithms for classical problems and the reasons for these differences; - are able to independently analyze and develop algorithms within the presented areas; - can fluently reason mathematically and express their ideas in written form as evidence; - gain insight into the current state of research.
Partial module exams (number, form, scope):	Exam types: Written exam, 90-120 mins. Oral exam, 30-45 mins.
Self-study time (in hours [h]):	120

	Contact time	Supplementary ex (number, form, scop	Course accompanying		
Courses (teaching format)	(in semester hours)	For completion of module	For admission to module exam	module (partial) exam (s) (number, form, scope)	
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (50%)	-	
Frequency of offer:		WiSe			
Prerequisite:		None			
Department:		Digital Engineering			

HPI-CS-AMC: Advanced Machine Learning - Cor		2	Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: This module prov foundations of r probabilistic learn supervised learnin processes as well modeling, recomm challenges such as model validation a students should be innovative problem Qualification goal The students acqui module. Students: - gain comprehenss machine learning; - acquire the abili make predictions a - can implement a digital health relev or financial analys - deepen knowled are essential for m - can apply what th exercises and proj - gain in-depth kn	ides knowledge of ad nachine learning an ning, deep learning, g. Content includes t as practical use case nendation systems, in data bias and overfir and performance eval e able to develop new n solutions using mac s: re detailed knowledge ive knowledge of con ty to recognize and a and decisions; llgorithms and train t vant-areas, such as im is; ge of statistical meth achine learning; ney have learned and ects; nowledge needed to l intelligence and mach	lvanced techniques nd artificial intell reinforcement lea the optimization of s in digital health, mage and text anal tting. Students also uation. After comp v machine learning chine learning. e of the specialist top accepts, algorithms, a analyze complex da models in order to age recognition, lar ods and optimization develop their own r be successful in the pine learning	and mathematical igence, including arning and semi- machine learning such as predictive lysis. It highlights learn methods for leting the module, methods and find pics covered in the and applications of ata patterns and to solve problems in nguage processing, on techniques that models in practical e rapidly evolving
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 45 mins.) Written exam, 90- Oral exam, 30-45	pages, together with 120 mins. mins.	a presentation of re	search results (20-
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
7				
Frequency of offer:		WiSe and SoSe		
Prerequisite:		None		
Department:		Digital Engineering		

HPI-CS-AMD: Advanced Machine Learning - Dec		ep Dive	Number of (CP): 6	credit points	
Module type (compulsory or compulsory elective module):	Compulsory elec	ctive module			
	Content: This module pro foundations of probabilistic lea supervised learn processes as wel modeling, recon challenges such model validation students should innovative probl	wides knowledge of ad machine learning ar arning, deep learning, ing. Content includes t ll as practical use cases mendation systems, in as data bias and overfin and performance eval be able to develop new em solutions using mac	lvanced techniques nd artificial intell reinforcement lea the optimization of s in digital health, mage and text anal tting. Students also uation. After comp w machine learning chine learning.	and mathematical igence, including arning and semi- machine learning such as predictive lysis. It highlights learn methods for leting the module, methods and find	
Content and qualification goals of the module:	Qualification gos The students acq module. Students: - gain comprehen machine learning	Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - gain comprehensive knowledge of concepts, algorithms, and applications of machine learning:			
	 acquire the ability to recognize and analyze complex data patterns and to make predictions and decisions; can implement algorithms and train models in order to solve problems in digital health relevant-areas, such as image recognition, language processing, or financial analysis; dearen knowledge of statistical methods and entimization technisms that 				
	are essential for - can apply what exercises and pro - gain in-depth world of artificia	machine learning; they have learned and develop their own models in practical ojects; knowledge needed to be successful in the rapidly evolving l intelligence and machine learning.			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins.			search results (20-	
Self-study time (in hours [h]):	120				
	Contact time	Supplementary exa (number, form, scope)	m requirements	Course accompanying	
Courses (teaching format)	(in semester hours)	For completion of module	For admission to module exam	module (partial) exam (s) (number, form, scope)	
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-	
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Frequency of offer:		WiSe and SoSe			
Prerequisite:		Prior participation in HPI-CS-AMC is recommended.			
Department:		Digital Engineering			

HPI-CS-AMS: Advanced Machir	ialization	Number of (CP): 6	credit points	
Module type (compulsory or compulsory elective module):	Compulsory elec	tive module		
Content and qualification goals of the module:	Content: This module prov foundations of r probabilistic learn supervised learnin processes as well modeling, recomr challenges such as model validation a students should be innovative probler Qualification goal The students acqui module. Students: - gain comprehenss machine learning; - acquire the abili make predictions a - can implement a digital health relev or financial analys - deepen their kno that are essential f - can apply what tl exercises and proj	ides knowledge of ad nachine learning ar ning, deep learning, ig. Content includes t as practical use case nendation systems, in s data bias and overfit and performance eval e able to develop new n solutions using mac s: ire detailed knowledge tive knowledge of con ty to recognize and a and decisions; algorithms and train tr vant-areas, such as im tis; owledge of statistical or machine learning; hey have learned and ects;	lvanced techniques nd artificial intell reinforcement lea the optimization of s in digital health, mage and text anal tting. Students also uation. After comp v machine learning thine learning. e of the specialist top neepts, algorithms, a analyze complex da models in order to age recognition, lan methods and optim	and mathematical igence, including arning and semi- machine learning such as predictive lysis. It highlights learn methods for leting the module, methods and find pics covered in the and applications of ata patterns and to solve problems in nguage processing, ization techniques models in practical
	world of artificial Exam types:	intelligence and mach	nine learning.	
Partial module exams (number, form, scope):	Paper of at least 8 45 mins.) Written exam, 90- Oral exam, 30-45	pages, together with 120 mins. mins.	a presentation of re	search results (20-
Self-study time (in hours [h]):	120			
		[1
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
	1	1		1
Frequency of offer:		WiSe and SoSe		
Prerequisite:		Prior participation in	n HPI-CS-AMC is r	ecommended.
Department:		Digital Engineering		

HPI-CS-ASC: Algorithms and Security - Core			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	 This module provides an introduction to the basics of IT security in the context of digital health. This includes identifying security risks, protecting against attacks and threats, ensuring data integrity and confidentiality, and implementing security policies and measures. This module also provides an introduction to the basics of algorithms and data structures relevant to the digital health industry. This includes concepts such as sorting algorithms, search algorithms, graph algorithms and optimal algorithms. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: learn decision-making algorithms in medical diagnosis, prognosis and treatment planning using machine learning algorithms, decision trees, artificial intelligence and other techniques; master the processing and analysis of large data sets (big data) using techniques such as data mining, statistical analysis, pattern recognition and machine learning; deepen their knowledge of cryptography and data protection, encryption techniques, secure communication, digital signatures and anonymization methods; expand their knowledge of security in connected devices and systems, security risks and measures related to connected medical devices, wearables 			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins. Oral exam, 30-45 mins.			
Self-study time	120			
(in hours [h]):	120			
Courses (teaching format)	Contact time (in semester	Supplementary ex (number, form, scop For completion of	am requirements e) For admission to	Course accompanying module (partial) exam (s)
\cap	nouisj	module	module exam	(number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at	-
(lecture of seminar)	<u> </u>	<u> </u>	10ast 30%)	
Frequency of offer:		WiSe and SoSe		
Prerequisite:		None		
Department:		Digital Engineering		

HPI-CS-ASD: Algorithms and Security - Deep Dive

Number of credit points (CP): 6____

Module type (compulsory or compulsory elective module):	Compulsory electi	ve module			
Partial module exams (number, form, scope):	Content: This module deepens the topics of IT security in the context of digital health. In today's connected world, the security of sensitive health data is critical. This module provides students with advanced knowledge to identify security risks, defend against attacks and threats, ensure data integrity and confidentiality, and implement security policies and measures. An important aspect of this module is the identification of complex security risks. Students learn to identify and analyze potential vulnerabilities and threats in digital health systems. These include, among others, insecure network communication, lack of access control, software and hardware vulnerability, inadequate encryption and social engineering attacks. Through a deeper understanding of these risks, students are able to take and develop appropriate protective measures. Algorithms play a crucial role here as they can be used to detect, analyze, and defend against threats and attacks. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - learn decision-making algorithms in medical diagnosis, prognosis and treatment planning using machine learning algorithms, decision trees, artificial intelligence and other techniques; - master the processing and analysis of large data sets (big data) using techniques such as data mining, statistical analysis, pattern recognition and machine learning; - deepen their knowledge of cryptography and data protection, encryption techniques, secure communication, digital signatures and anonymization methods; - expand their knowledge of security in connected devices and systems, security risks and measures related to connected medical devices, wearables				
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 45 mins.) Written exam, 90- Oral exam, 30-45	pages, together with a 120 mins. mins.	a presentation of res	search results (20-	
Self-study time (in hours [h]):	120				
Courses (teaching format)	Contact time (in semester hours)	Supplementary exa (number, form, scop) For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)	
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-	
Frequency of offer:	requency of offer: WiSe and SoSe				
Prerequisite:		Prior participation in HPI-CS-ASC is recommended.			
Department:		Digital Engineering			

HPI-CS-ASS: Algorithms and Se	curity - Specialization	Number of credit points (CP): 6
Module type (compulsory or compulsory elective module):	Compulsory elective module	
Content and qualification goals of the module:	Content: This module deepens the topics of IT secu In today's connected world, the security of module provides students with further security risks, ward off attacks and t confidentiality, and implement security po An important aspect of this module is the risks. Students learn to identify and analyz and threats in digital health systems. The network communication, lack of acces vulnerability, inadequate encryption and a deeper and more advanced understandin take and develop appropriate protective r role here as they can be used to detect, and attacks. Qualification goals: The students acquire detailed knowledge of module. Students: - learn decision-making algorithms in treatment planning using machine lead artificial intelligence and other techniques - master the processing and analysis o techniques such as data mining, statistic machine learning; - deepen their knowledge of cryptograp techniques, secure communication, dig methods; - expand their knowledge of security i security risks and measures related to coi and other digital health systems	urity in the context of digital health. f sensitive health data is critical. The ; in-depth knowledge to identify threats, ensure data integrity and olicies and measures. e identification of complex security ze potential, complex vulnerabilities ese include, among others, insecure ss control, software and hardware social engineering attacks. Through ng of these risks, students are able to measures. Algorithms play a crucial alyze and defend against threats and of the specialist topics covered in the medical diagnosis, prognosis and arning algorithms, decision trees, s; of large data sets (big data) using eal analysis, pattern recognition and ohy and data protection, encryption gital signatures and anonymization in connected devices and systems, onnected medical devices, wearables
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a p 45 mins.) Written exam, 90-120 mins.	presentation of research results (20-
Self-study time	Oral exam, 30-45 mins. 120	

	Contact time	Supplementary ex (number, form, scop	Course accompanying		
Courses (teaching format)	(in semester hours)	For completion of module	For admission to module exam	module (partial) exam (s) (number, form, scope)	
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-	
Frequency of offer:		WiSe and SoSe			

Frequency of offer:	WiSe and SoSe
Prerequisite:	Prior participation in HPI-CS-ASC is recommended.
Department:	Digital Engineering

HPI-CS-ATC: Algorithm Theory - Core			Number of (CP): 6	credit points	
Module type (compulsory or compulsory elective module):	Compulsory	elective module			
Content and qualification goals of the module:	Content: In this module, approaches for solving NP-hard problems (e.g., approximation algorithms, parameterized algorithms) are discussed. The focus is on the mathematical version of the solution, especially algorithm analysis and algorithm design. Impossibility results complement the field of algorithm development. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - know approaches for solving NP-hard problems; - know central impossibility results; - understand in detail the advantages and disadvantages of the approach to solving NP-hard problems; - can independently analyze and develop algorithms within the presented areas; - deepen their ability to reason mathematically and write down their ideas as evidence; - gain in-depth insights into the current state of research.				
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins. Oral exam 30-45 mins				
Self-study time	120				
(in hours [h]):	120				
Courses (teaching format)	Contact time (in semester hours)	Supplementary exar (number, form, scope) For completion of module	n requirements For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)	
Project seminar/seminar/ lecture	4	-	Exercises (at	-	
(lecture or seminar)			least 50%)		
Frequency of offer:		WiSe and SoSe			
Prerequisite: None Department: Digital Engineering					

HPI-CS-ATD: Algorithm Theory - Deep Dive			Number of (CP): 6	credit points	
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module			
Content and qualification goals of the module:	Content: In this module, approaches for solving NP-hard problems (e.g., approximation algorithms, parameterized algorithms) are discussed. The focus is on the mathematical version of the solution, especially algorithm analysis and algorithm design. Impossibility results complement the field of algorithm development. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - know approaches for solving NP-hard problems; - know central impossibility results; - understand in detail the advantages and disadvantages of the approach to solving NP-hard problems; - can independently analyze and develop algorithms within the presented areas; - deepen their ability to reason mathematically and write down their ideas as evidence; - gain in-depth insights into the current state of research.				
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins. Oral exam, 30-45 mins.				
Self-study time	120				
Courses (teaching format)	Contact time (in semester	Supplementary ex (number, form, scop	am requirements be)	Course accompanying module (partial)	
	hours)	For completion of module	For admission to module exam	exam (s) (number, form, scope)	
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (50%)	-	
			•		
Frequency of offer:		WiSe and SoSe			
Voraussetzung für die Teilnahme am Modul:		None			
Anbietende Lehreinheit(en):		Digital Engineering			

HPI-CS-ATS: Algorithm Theory - Specialization			Number of (CP): 6	credit points	
Module type (compulsory or compulsory elective module):	Compulsory electi	ive module			
Content and qualification goals of the module:	Content: In this module, approaches for solving NP-hard problems (e.g., approximation algorithms, parameterized algorithms) are discussed. The focus is on the mathematical version of the solution, especially algorithm analysis and algorithm design. Impossibility results complement the field of algorithm development. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - know approaches for solving NP-hard problems; - know central impossibility results; - understand in detail the advantages and disadvantages of the approach to solving NP-hard problems; - can independently analyze and develop algorithms within the presented areas; - deepen their ability to reason mathematically and write down their ideas as evidence; - gain in-depth insights into the current state of research.				
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins. Oral exam, 30-45 mins.				
Self-study time	120				
(in nours [n]):					
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)	
Project seminar/seminar/ lecture	4	-	Exercises (at	-	
(lecture or seminar)			least 50%)		
F 6 66					
Frequency of offer:		W1Se and SoSe			
Prior participation in HPI-CS-ATC is recommend		ecommended.			
		Digital Digitieering			

HPI-CS-C: Cryptography	Number of credit points (CP): 6				
Module type (compulsory or compulsory elective module):	Compulsory modu	Compulsory module/Compulsory elective module			
Content and qualification goals of the module:	 This module teaches the basics of cryptography. Methods for formulating security properties are introduced and the functionality of modern cryptographic methods explained. Symmetrical and asymmetrical methods and algorithms are presented and their properties analyzed. These include procedures such as pseudo-random functions and symmetric and public-key encryption to protect the confidentiality of information, as well as message authentication codes and digital signatures to protect integrity and authenticity. The number theoretic foundations required for asymmetric cryptography are examined. After completing the module, students should be able to understand the basic concepts and procedures of cryptography and be able to use them correctly. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: acquire a comprehensive understanding of the properties of various cryptographic methods (e.g., asymmetric and symmetric encryption, cryptographic hash functions); become versed in the basic principles of modern cryptography and complexity theory security; gain an algorithmic and formal understanding in order to be able to analyze and understand security properties; know the most important procedures for encryption, key exchange and signatures; can decide which cryptographic procedures may be used for specific goals in practice; 				
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins.				
Self-study time (in hours [h]):	120				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)	
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-	
		I			
Frequency of offer: SoSe		SoSe			
Prequisite:		None			
Department:		Digital Engineering			

HPI-CS-CAC: Cyber Attack and Defense - Core			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory elective module			
Content and qualification goals of the module:	Content: This module teach systems and comp attack as well as analysis and detec by which an attach for preventing spe Qualification goals The students acqui module. Students: - gain subject-spec - expand their prof - develop discussio - gain experience i and complex infra - are able to indep solve problems; - can assess the a problems; - gain the ability to - can critically exa their professional s	es basic concepts and blex infrastructures. V the commonly used tion approaches are p c can be identified in cific attacks considered s: re detailed knowledge cific theoretical and m fessional judgment sk on skills and techniqu n dealing with concep structures; endently develop and applicability of solution pply suitable solution o present and defend t mine solutions to pro suitability.	methods for the atta Ve consider the relea d methods. In add resented for the atta the corresponding p ed. e of the specialist top nethodological know ills; es; ots and methods for use suitable sources ion concepts and s n concepts and stra heir work; blems developed by	ack and defense of evant phases of an lition, appropriate ack methods used, phase, and options pics covered in the vledge; defending systems s of information to trategies to given ategies to a given
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins. Oral exam 30.45 mins			
Self-study time	120			
(in hours [h]):				
Courses (teaching format)	Contact time (in semester hours)Supplementary exam requirer (number, form, scope)For completion of moduleFor admissi- module exam		am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at	-
(lecture or seminar)			least 50%)	
Frequency of offer:		WiSe and SoSe		
Prerequsite:		None		
Department:		Digital Engineering		

HPI-CS-CAD: Cyber Attack and Defense - Deep D		ve	Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	This module teaches basic concepts and methods for the attack and defense of systems and complex infrastructures. We consider the relevant phases of an attack as well as the commonly used methods. In addition, appropriate analysis and detection approaches are presented for the attack methods used, by which an attack can be identified in the corresponding phase, and options for preventing specific attacks considered. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - gain subject-specific theoretical and methodological knowledge; - expand their professional judgment skills; - develop discussion skills and techniques; - gain experience in dealing with concepts and methods for defending systems and complex infrastructures; - are able to independently develop and use suitable sources of information to solve problems; - can assess the applicability of solution concepts and strategies to given problems; - can select and apply suitable solution concepts and strategies to a given problem; - gain the ability to present and defend their work; - can critically examine solutions to problems developed by others and assess their professional suitability.			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins.			
Self-study time	120			
(in nours [n]):				
	Contact time (in semester	Supplementary ex (number, form, scop	am requirements e)	Course accompanying module (partial)
Courses (teaching format)	hours)	For completion of module	For admission to module exam	exam (s) (number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at least 50%)	-
	l	l	10450 5070	1
Frequency of offer:		WiSe and SoSe		
Prerequisite:		Prior participation in	n HPI-CS-CAC is re	ecommended.
Department:		Digital Engineering		

HPI-CS-CAS: Cyber Attack and	zation	Number of (CP): 6	credit points	
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: This module teach systems and comp attack as well as analysis and detec by which an attach for preventing spe Qualification goals The students acqui module. Students: - gain subject-spec - expand their prof - develop discussio - gain experience i and complex infra - are able to indep solve problems; - can assess the a problems; - gain the ability to - can critically exa their professional s	es basic concepts and blex infrastructures. V the commonly user tion approaches are p c can be identified in cific attacks considerer s: re detailed knowledge cific theoretical and m fessional judgment sk on skills and techniqu n dealing with concep structures; endently develop and applicability of solut upply suitable solution o present and defend t mine solutions to pro suitability.	methods for the atta Ve consider the rele d methods. In add presented for the atta the corresponding p ed. e of the specialist top nethodological know ills; es; ots and methods for use suitable sources ion concepts and s n concepts and stra- their work; blems developed by	ack and defense of evant phases of an lition, appropriate ack methods used, phase, and options pics covered in the vledge; defending systems s of information to trategies to given ategies to a given
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins. Oral exam, 30-45 mins			
Self-study time	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at	-
(lecture or seminar)			least 50%)	
Frequency of offer:		WiSe and SoSe		
Prerequisite		Prior participation in	HPLCS.CAC is re	ecommended
Department:		Digital Engineering	1 111 I-US-UAU IS R	
Department.		I Digital Engineering		

HPI-CS-CPC: Advanced Crypto	graphy and Protoc	ols - Core	Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: In this module, stui in the area of cr security protocol cryptography are computation, thress the fundamental re and analysis of the relevant scenarios. Qualification goals The students acqui module. Students: - know advanced c protocols; - can analyze comp correctness; - are familiar with examine given pro- can analyze secu - are familiar with and have developed area; - are able to con decision-makers in	dents gain knowledge yptography and com s are analyzed an discussed, such as hold cryptography, an esults in these areas, e protocols, their func- s: re detailed knowledge oncepts and methods plex cryptographic pr known attack metho tocols for them; rity protocols for vult current research tren ed an awareness of th mmunicate complex n an understandable m	e of advanced techni imunication protoco ad advanced meth zero-knowledge pr nd post-quantum sec students become ve ctionality and applic e of the specialist top of cryptography and imitives and protoco ods and vulnerabiliti nerabilities; ds and development e challenges and op theoretical concep	ques and concepts ols. Network and nods of modern roofs, multi-party curity. Building on ersed in the design ations in practice- pics covered in the d complex security ols and prove their des and are able to ts in cryptography oportunities in this ts and results to
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins. Oral exam 30-45 mins			
Self-study time	120			
(in nours [n]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form,
Project seminar/seminar/ lecture	4	-	Exercises (at	scope) -
(lecture or seminar)			least 50%)	
E 0.00		WG 10 C		
Prequency of offer:		W1Se and SoSe		
Prerequisite:		None Digital Engineering		
Department:		Digital Engineering		

HPI-CS-CPD: Advanced Cryptography and Protocols - Deep Dive Number of credit points (CP): 6				
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	In this module, students gain knowledge of advanced techniques and concepts in the area of cryptography and communication protocols. Network and security protocols are analyzed and advanced methods of modern cryptography are discussed, such as zero-knowledge proofs, multi-party computation, threshold cryptography, and post-quantum security. Building on the fundamental results in these areas, students become versed in the design and analysis of the protocols, their functionality and applications in practice- relevant scenarios. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - know advanced concepts and methods of cryptography and complex security protocols; - can analyze complex cryptographic primitives and protocols and prove their correctness; - are familiar with known attack methods and vulnerabilities and are able to examine given protocols for them; - can analyze security protocols for vulnerabilities; - are familiar with current research trends and developments in cryptography and have developed an awareness of the challenges and opportunities in this area; - are able to communicate complex theoretical concepts and results to decision-makers in an understandable manner.			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins. Oral exam, 30-45 mins			
Self-study time	120			
(in nours [n]):				
Courses (teaching format)	(Contact time in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at	-
(lecture or seminar)			least 50%)	
Eraguanay of offer		Wise and Seco		
Prevency of other:		W1Se and SoSe		
Department:		Digital Engineering		commended.
Department:		Digital Engineering		

HPI-CS-CPS: Advanced Cryptography and Protocols - Specialization Number of credit points (CP): 6					
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module			
Content and qualification goals of the module:	In this module, students gain knowledge of advanced techniques and concepts in the area of cryptography and communication protocols. Network and security protocols are analyzed and advanced methods of modern cryptography are discussed, such as zero-knowledge proofs, multi-party computation, threshold cryptography, and post-quantum security. Building on the fundamental results in these areas, students become versed in the design and analysis of the protocols, their functionality and applications in practice- relevant scenarios. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - know advanced concepts and methods of cryptography and complex security protocols; - can analyze complex cryptographic primitives and protocols and prove their correctness; - are familiar with known attack methods and vulnerabilities and are able to examine given protocols for them; - can analyze security protocols for vulnerabilities; - are familiar with current research trends and developments in cryptography and have developed an awareness of the challenges and opportunities in this area; - are able to communicate complex theoretical concepts and results to decision-makers in an understandable manner.				
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 mins.				
Self-study time	120				
(in hours [n]):					
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)	
Project seminar/seminar/ lecture	4	-	Exercises (at	-	
(lecture or seminar)			1east 50%)		
Frequency of offer:		WiSe and SoSe			
Prerequisite		Prior participation in	HPLCS CPC in the	commended	
Department:		Digital Engineering		Commended.	
Department.					

HPI-CS-CR: Critical Reading and Discussion			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory modu	ıle		
Content and qualification goals of the module:	Content: This module deals with the compilation, analysis, evaluation, and presentation of current literature with a research focus on computer science. Accordingly, events in this module are assigned to specific tracks. Furthermore, the verbal presentation and discussion of content is at the level of current research. In this module, a great depth of understanding is achieved in a highly focused research area. Qualification goals: Students improve their methodological skills within their track. Students: - practice reading and understanding current literature on a topic; - can integrate various, sometimes (seemingly) contradictory information on a topic; - develop their ability to present findings and connections in speech and writing; - deepen their ability to argue and evaluate; - gain in-depth insights into the current state of research. Exam types:			
Partial module exams (number, form, scope):	Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Paper of at least 12 pages			
Self-study time (in hours [h]):	120			
	Contact time (in semester hours)	Supplementary ex (number, form, scop	Supplementary exam requirements (number, form, scope)	
Courses (teaching format)		For completion of module	For admission to module exam	module (partial) exam (s) (number, form, scope)
Critical Reading and Discussion (Seminar)	4	-	-	-
Frequency of offer:		WiSe and SoSe		
Prerequisite:		It is recommended that students first visit at least two compulsory modules of the track to which the respective course in this module is assigned.		
Department:		Digital Engineering		

HPI-CS-DA: Data Analytics	Number of credit points (CP): 6			
Module type (compulsory or compulsory elective module):	Compulsory modu	lle/ compulsory electi	ve module	
Content and qualification goals of the module:	Content: This module teaches advanced techniques and concepts related to research in the areas of supervised learning, unsupervised learning, multivariate statistics and interactive data exploration, such as clustering, classification, regression and other machine learning methods. Students are exposed to the limits of basic methods for mastering large and complex data and taught new paradigms that scale with the size and complexity of the data. They are provided a profound, formal understanding of various data analysis paradigms. A practical understanding of the methods is deepened through exercises in empirical comparison that accompany the lectures. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - understand the need for advanced data analytics concepts; - acquire knowledge of different methods for analyzing large and complex data sets such as clustering, classification, or regression; - can assess these methods in terms of their effectiveness and applicability and compare them on a formal and empirical level; - gain experience handling data analytics systems and tools; - know which problems are currently open in the area of data analytics; - have gained insights into current approaches of solutions in industrial and research projects and into the current state of research.			
Partial module exams (number, form, scope):	Exam types: Written exam, 90- Oral exam, 30-45	120 mins. mins.		
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester	Supplementary ex (number, form, scop For completion of	am requirements be) For admission to	Course accompanying module (partial) exam (s)
	nours)	module	module exam	(number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
Frequency of offer		SoSe		
Prerequisite:		None		
Department:	Digital Engineering			

HPI-CS-DAC: Data Systems - Core		Number of credit points (CP): 6		
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	A data-driven system benefits from the use of many heterogeneous data sources with complex content. The specialization area of data systems in the subject of of data engineering deals with methods, concepts, procedures, and techniques for systems that develop and use such data. Students learn the basic concepts and methods for representing, storing, processing and analyzing complex data such as trees, graphs and networks, execution data, event sequences, time series, texts and multimedia data. Topics such as specialized and complex query languages, special database concepts, modern hardware, or methods for processing data streams are also covered. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - gain subject-specific theoretical and methodological knowledge of the various data systems; - master the representation, storage and analysis of, for example, graph or text data; - expand their professional judgment skills; - acquire the ability to independently develop and use suitable sources of information to solve problems; - learn how to independently work on a topic based on primary and secondary literature; - gain experience in formalizing and abstracting problems for various types of complex data.			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes Oral exam 30-45 minutes			
Self-study time	120			
(in nours [h]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at	-
(lecture or seminar)			least 50%)	
Frequency of offer:		W1Se and SoSe		
Prerequisite:		None Digital Equip		
Department:		Digital Engineering		

HPI-CS-DAD: Data Systems - Deep Dive			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module	, , , , , , , , , , , , , , , , ,	
	Content: This module covers techniques and tools of data engineering in the specialization area of data systems. Module courses include those on the topic of text and multimedia data, event data, graphs or data streams. The module's focus is on current processes, techniques, and tools from science and industry. Students examine how data-driven IT systems deal with the challenges that complex data types pose to their collection, processing, storage, and analysis. Among the data types studied are trees, graphs and networks, execution data, event sequences, time series, text as well as image and audio data. Qualification goals: Students acquire detailed knowledge about the specialist topics covered in the			
Content and qualification goals of the module:	 s of Students: gain subject-specific methodological and practical knowledge of data systems; learn to process complex data types such as executive and multimed expand their professional judgment skills; acquire the ability to solve problems of various types complex independently develop and use suitable sources of information; learn how to independently work on a topic based on primary and set literature; are able to follow current research trends and incorporate these in work; can select and apply appropriate solutions concepts and strategy specific problem are able to follow current research trends and incorporate these and incorporate the set of solutions concepts and strategy specific problem are able to follow current research trends and incorporate trends and incorporate the set of solutions concepts and strategy specific problem are able to follow current research trends and incorporate trends and incorporate the set of solutions concepts and strategy specific problem are able to follow current research trends and incorporate trends and incorporate the set of solutions concepts and strategy specific problem are able to follow current research trends and incorporate the set of solutions concepts and strategy specific problem are able to follow current research trends and incorporate trends and incorporate the set of solutions concepts and strategy specific problem are able to follow current research trends and incorporate tresearch trends			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes Oral exam, 30-45 minutes			
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form,
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
Frequency of offer:		WiSe and SoSe		
Prerequisite:		Prior participation in	n HPI-CS-DAC is r	ecommended.
Department:		Digital Engineering		

HPI-CS-DAS: Data Systems - Sp	ecialization	Number of credit points (CP): 6		
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module	, , , , , , , , , , , , , , , , ,	
Content and qualification goals of the module:	Content: This module invo engineering in th examine the efficie of complex data, w beyond classic pa results. Content co processing, netwo analysis, compute retrieval for comp Qualification goal Students acquire d module. Students: - work out the lim. - deal with new of stream synopsis; - learn the scientif systems; - are able to select given problem; - have the ability integrate them into - can independent! - are experienced i of complex data; - get to know crite - can critically exa their professional st	estigates current rese estigates current rese ent and scalable collect which require new an radigms. The focus overs the current state ork science, natural r vision, stream min lex data types. s: etailed knowledge ab- itations and extension data technologies suc- tic analysis of current et and apply suitable to follow current r o their work; y access and evaluate in formalizing and ab ria and principles of s mine solutions to pro suitability.	earch questions an a "data systems." ction, processing, st d innovative approa- is on current resea e of research on top l language proces- ing, graph synopsis out the specialist top the specialist top top the specialist top top the specialist top top the specialist top top the specialist top top the specialist top top top the specialist top top top top top top top top top top	d results in data Students thereby orage and analysis aches and systems rch questions and ics such as stream sing, multimedia s and information bics covered in the ex data systems; age processing or in the area of data and strategies to a data systems and on specific topics; with various types
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes Oral exam, 30-45 minutes			
Self-study time (in hours [h]):	120			
\sim	Contact time	Supplementary ex (number, form, scop	am requirements be)	Course accompanying
Courses (teaching format)	Contact time (n (in semester hours) F	For completion of module	For admission to module exam	module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at	-
(lecture or seminar)			1east 50%)	
Frequency of offer		Wise and Sasa		
Prerequisite:		Prior participation in	HPLCS-DAC is re	ecommended
Department:		Digital Engineering		commended.

HPI-CS-DEC: Application Development and Software Engineering - Number of credit points (CP): 6				
Module type (compulsory or			(01):0	
compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: This module pro development, inc methodologies, ve and data integratio digital health appl systems and devic Furthermore, par implementation of use of programmi implement feature The module pr requirements for c conception and de includes understar using modeling tec Qualification goal Students acquire d module. Students: - learn to develop - gain programmi that meet the requi - expand their ab effectively in the c - learn to select a application to crea - are able to appl healthcare sources	vides an introductio cluding the softwa rsion control, testing a on. It examines the issu- lications to enable the es. rticipants gain an f software developme ng languages and fra es such as database a ovides knowledge ligital health applicat sign of the software a nding user needs, crea- chniques, such as use s: etailed knowledge ab and implement digital ng knowledge and te- irements of digital hea- bility to design softw ligital healthcare indu- architectural patterns te a scalable and main y the optimal technic and ensure interoper	n to the fundame re life cycle, ag and quality assurand ue of implementing e exchange of data understanding of nt in digital health. meworks to develop ccess, user interface about identifying ions and provides a rchitecture of these ating requirements cases or user storie out the specialist top l health applications chniques to create a althcare; ware architectures istry; and organize the of ntainable solution; ques to integrate d ability between diff	ntals of software gile development ce, interoperability interoperability in between different of the practical This includes the p applications and ces and interfaces. g and recording in overview of the applications. This specifications and s. pics covered in the s; software solutions that can be used components of an ata from different cernt systems;
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 45 mins.) Written exam, 90- Oral exam, 30-45	pages, together with 120 minutes minutes	a presentation of re	search results (20-
Self-study time	120			
(m nours [nj):	ľ			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
	l	l	10031 5070)	
Frequency of offer:		WiSe and SoSe		
Prerequisite:		None		
Department:		Digital Engineering		

HPI-CS-DED: Application Devel Deep Dive	opment and Softwa	ware Engineering - Number of credit points (CP): 6			
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module			
Content and qualification goals of the module:	Content: This module pro- including softward testing and quali- deepens the imple to enable the excha- This module als development in di- and frameworks to features such as do provides deeper k digital health appli- design of the soft depth understandin- using modeling tea Qualification goal. The students acqui- module. Students: - practice developi- - gain advanced p solutions that mee - expand their abil be used effectively - practice selectin components of an - evaluate and app sources in the hea systems; - double in the for the soft - gain double and app	wides advanced knowled e life cycle, agile de ty assurance, interop- ange of data between to deepens the pra- igital health. This inco- o develop more com- atabase access, user i the digital health. This inco- o develop more com- atabase access, user i the digital health. This inco- o develop more com- atabase access, user i the digital health of the digital magnetic such as used the requirements of ity to design more co- or in the digital health of the optimal technical the sector and to ensu- alth sector and to ensu- alth in working with	owledge of softw velopment methods perability, and da erability in digital h different systems an ctical implementa cludes using progra- nplex applications in nterfaces and interf ying and recording urther overview of t these applications. ating requirements cases or user stories e of the specialist top digital health appli lge and techniques digital healthcare; mplex software arc care industry; erns, analyzing an a scalable and main iques to integrate d ure interoperability	are development, s, version control, ta integration. It health applications ind devices. tion of software umming languages and to implement faces. The module g requirements for the conception and This includes in- specifications and s. pics covered in the ications; to create software hitectures that can and organizing the tainable solution; lata from different	
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 45 mins.) Written exam, 90- Oral exam, 30-45	pages, together with 120 minutes minutes	a presentation of re	search results (20-	
Self-study time (in hours [h]):	120				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)	
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-	
Frequency of offer:		WiSe and SoSe			
Prerequisite: Department:		Prior participation in HPI-CS-DAC is recommended. Digital Engineering			

HPI-CS-DES: Application Develor Specialization	Are Engineering - Number of credit points (CP): 6				
Module type (compulsory or compulsory elective module):	Compulsory electi	tive module			
Content and qualification goals of the module:	This module provides advanced knowledge of software development, including software life cycle, agile development methods, version control, testing and quality assurance, interoperability in digital health applications to enable the exchange of data between different systems and devices. This module also deepens the practical implementation of software development in digital health. This includes using programming languages and frameworks to develop more complex applications and to implement features such as database access, user interfaces and interfaces. The module provides deeper knowledge of identifying and recording requirements for digital health applications and offers a further overview of the conception and design of the software architecture of these applications. This includes in- depth understanding of user needs, creating requirements specifications and using modeling techniques such as use cases or user stories. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - practice developing and implementing digital health applications; - gin advanced programming knowledge and techniques to create software solutions that meet the requirements of digital health applications; - expand their ability to design more complex software architectures that can be used effectively in the digital healthcare industry; - practice selecting architectural patterns, analyzing and organizing the components of an application to create a scalable and maintainable solution; - evaluate and apply the optimal techniques to integrate data from different sources in the health sector and to ensure interoperability between different systems;				
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes Oral exam, 30-45 minutes				
Self-study time (in hours [h]):	120				
Courses (teaching format) Contact time (in semester hours)	Supplementary exam requirements (number, form, scope)		Course accompanying module (partial) exam (s) (number, form, scope)		
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-	
Frequency of offer:		WiSe and SoSe			
Prerequisite:		Prior participation in HPI-CS-DEC is recommended.			
Department:		Digital Engineering			

HPI-CS-DIC: Data Integration - Core		Number of credit points (CP): 6				
Module type (compulsory or compulsory elective module):	Compulsory modu	ıle				
Content and qualification goals of the module:	Content: A data-driven system is often based on data from various heterogeneous data sources with different data models, schema and data. Such data often needs to be collected, pre-processed and cleaned. Data integration is about making this data usable. The data integration methods include concepts for data selection, preprocessing (data preparation), analyzing the raw data (data profiling), data cleansing, as well as transformation and aggregation. The focus of this module is on the corresponding fundamental concepts and methods for the technical, structural and semantic development of diverse data sources for data-based systems. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - learn concepts and methods, for example in the areas of data preparation, data profiling and data cleansing; - can assess the data quality of various data sources and models; - can select and apply suitable solution concepts and strategies to a given problem; - expand their professional judgment skills; - acquire the abilty to independently develop and use suitable sources of information to solve problems; - learn about relevant analysis methods; - evaluate data integration strategies for different requirements; - recognize complex data development problems and are able to develop appropriate solution strategies; - acquire technical language knowledge;					
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes Oral exam, 30-45 minutes					
Self-study time (in hours [h]):	120					
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)		
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-		
Frequency of offer:		WiSe and SoSe				
Prerequisite:		None				
Department:		Digital Engineering				

HPI-CS-DID: Data Integration -	Number of credit points (CP): 6				
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module			
	Content: A data-driven system is often based on data from various heterogeneous data sources with different data models, schema and data. Such data often needs to be collected, pre-processed and cleaned. Data integration is about making this data usable. The data integration methods include concepts for data selection, preprocessing (data preparation), analyzing the raw data (data profiling), data cleansing, as well as transformation and aggregation. The focus of this module is on the corresponding fundamental concepts and methods for the technical, structural and semantic development of diverse data sources for data-based				
Content and qualification goals of the module:	 systems. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: learn concepts and methods, for example in the areas of data preparation, data profiling and data cleansing; can assess the data quality of various data sources and models; can select and apply suitable solution concepts and strategies to a given problem; expand their professional judgment skills; acquire the abilty to independently develop and use suitable sources of information to solve problems; learn about relevant analysis methods; evaluate data integration strategies for different requirements; recognize complex data development problems and are able to develop appropriate solution strategies; 				
Partial module exams (number, form, scope):	- expand their learning skills. Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes				
Self-study time (in hours [h]):	120				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)	
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-	
Frequency of offer:		WiSe and SoSe			
Prerequiste:		Prior participation in HPI-CS-DIC is recommended.			
Department:		Digital Engineering			
HPI-CS-DIS: Data Integration - Specialization			Number of (CP): 6	credit points	
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Module type (compulsory or compulsory elective module):	Compulsory electi	ve module			
Content and qualification goals of the module:	Content: A data-driven syst sources with differ be collected, pre-p data usable. The d- preprocessing (dat cleansing, as well a is on the correspon structural and sem systems. Qualification goals The students acqui module. Students: - learn concepts a data profiling and - can assess the da - can select and a problem; - expand their prof - acquire the abil information to solv - learn about relev - evaluate data inte - recognize comp appropriate solutio - acquire technical - expand their lear	em is often based on rent data models, sche rocessed and cleaned ata integration metho a preparation), analyz as transformation and nding fundamental co nantic development o s: re detailed knowledge nd methods, for exar data cleansing; ta quality of various o upply suitable solution fessional judgment sk ty to independently ve problems; ant analysis methods; egration strategies for lex data development on strategies; language knowledge ning skills.	data from various h ema and data. Such a . Data integration is ds include concepts zing the raw data (d. aggregation. The for incepts and methods f diverse data source e of the specialist top nple in the areas of data sources and mo n concepts and stra ills; develop and use su different requirement problems and areas	eterogeneous data data often needs to about making this for data selection, ata profiling), data ocus of this module s for the technical, ces for data-based pics covered in the f data preparation, odels; ategies to a given uitable sources of ents; e able to develop	
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes			search results (20-	
Self-study time (in hours [h]):	120				
Courses (teaching format) Courses (teaching format) Contact time (in semester hours)	Contact time (in semester hours)	Supplementary ex (number, form, scop	am requirements be)	Course accompanying module (partial) exam (s) (number, form	
	module	module exam	scope)		
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-	
Frequency of offer:		WiSe and SoSe			
Prerequiste:		Prior participation in	n HPI-CS-DIC is re	commended.	
Department:		Digital Engineering			

HPI-CS-DM: Data Management	and Data Science	Number of credit points (CP): 6		
Module type (compulsory or compulsory elective module):	Compulsory modu	lle/compulsory electiv	ve module	
Content and qualification goals of the module:	Contents: Obtaining insights data sources are imparting of bas management is interdisciplinary so medicine, enables health data. These and provide recon answers generated methods used mus aspects of organiz: This module provi as part of the analy Qualification goal: The students acqui module. Students: - gain subject-sp generation and dat - understand the of clinical research p - can use suitable research questions - gain experience tools; - gain the ability to - are able to use a organize data, and - learn statistical m and trends in the d - master the basic decisions; - gain in gain insights int	a from large amounts highly relevant topi ic knowledge in th essential. Data So- cience at the intersect the generation of he can be used to answer mmendations for act l, the quality, integrit st be ensured. Data n ing, structuring, stori des an understanding vis and evaluation of s: re detailed knowledg ecific methodologica a analysis in the field challenges of data m rocesses); e methods to empiric , make predictions, ai in dealing with big of o critically question ar ppropriate methods to ensure data quality a bethods and machine I ata and make predict cs of clinical researc	of data and managi cs for digital healt he areas of data is science in Digital ion of statistics, may calth-relevant insight research questions, tion. To ensure the ty, and reliability of hanagement in digit of data science and digital health data. e of the specialist top al and practical kn of digital health data. e of the specialist top al and practical kn of digital health; anagement of healt cally investigate given data protection; earning algorithms to ions; h and learn to male proaches from indu-	ing heterogeneous th. Therefore, the science and data Health, as an chine learning and hts from extensive make predictions, e accuracy of the f the data and the tal health includes rol for health data. data management pics covered in the nowledge in data h data (e.g., from wen problems and uestions; nd the appropriate ts of data analysis; collect, store, and to identify patterns ce evidence-based ustry and research
Partial module exams (number	Exam types:			
form, scope):	Written exam, 90-	120 minutes	dan falaan Jan F	
Self-study time	0rai exam, $30-45$	minutes Eine Prufung	g der lolgenden Fori	nen:
(in hours [h]):	120			
Courses (teaching format)	Contact time (in semester	Supplementary ex (number, form, scop	am requirements be)	Course accompanying module (partial)
	nours)	For completion of module	For admission to module exam	exam (s) (number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (50%)	-
(lecture or seminar)				
Eroquerey of -ff		C _ C _		
Prerequiste:		None		
Department:		Digital Engineering		
Department:		Digital Engineering		

HPI-CS-DS: Data Systems			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory modu	lle/compulsory electiv	ve module	
Content and qualification goals of the module:	Contents: Digitalization and whose characteris growing amounts techniques and m module teaches processing of dat processing of dat processing system handling data fro acquisition frequen (Volume). In addi uses, the focus o architecture, data distribution, imple the art. Qualification goal The students acqui module. Students: - recognize the cha data engineering o - master the basic their structure, and - can select and a problem; - gain experience system architectur - acquire the abilit and distributed dat - gain subject-spec - can independent problems; - gain insights in projects and into the	increasing networkin stics and processing of data, and the result ethods for collecting architectures and m a, and addresses the som heterogeneous so ney and fast processin tion to a systematizat f analysis is on chara a structures, transa- ementation concepts a s: ire detailed knowledge allenges of big data pro- on IT systems; characteristics of big of d can incorporate thes upply suitable solution in dealing with soft es; y to evaluate and app ta processing; cific theoretical, meth ly access and use sui- to current solution a he current state of res	g are generating ne differ from prev ing analysis possibility transforming and ethods for the di e challenges faced scussion of system ources (Variety), g times (Velocity), ion of the systems racteristic system practional behavior, and their classificat e of the specialist to oblems (volume, van data and data engine e into development n concepts and stra ware systems and ly methods and pro odological, and pra- table sources of int pproaches in indus earch.	w volumes of data ious data. These ilities, require new l processing. This stributed, parallel by scalable data a architectures for data with a high and extensive data and their intended properties such as scalability and ion in the state of pics covered in the riety, velocity) and eering systems and processes; ategies to a given tools and scalable cedures of parallel ctical knowledge, formation to solve
Partial module exams (number.	Exam types:	ne current state of res		
form, scope):	Written exam, 90- Oral exam, 30-45	120 minutes minutes		
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop) For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form,
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (50%)	scope) -

Frequency of offer:	WiSe
Prerequiste:	None
Department:	Digital Engineering

HPI-CS-DSC: Dependable Systems - Core			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module	· · · · ·	
Content and qualification goals of the module:	Content: This module teac development and of Scientific concept covered, such as integrity. Through methods and techr networks. Qualification goal The students acqui module. Students: - gain subject-spec - expand their prof - develop discussio - acquire experie operation of system - are able to indep solve problems; - can assess the a problems; - can select and a problem; - can present self-of - can critically que their professional	hes scientific concept operation of dependates and methods for of availability, reliability out the module, study indues for safety-criticant s: re detailed knowledge effic theoretical and me fessional judgment sk for skills and technique nce in dealing with ms, and aspects of relendently develop and applicability of solution the solution solutions to pro- suitability.	pts, methods and t ble systems. ne or more aspects ty, safety, informa ents deal with, for e cal systems, secure s e of the specialist to nethodological know ills; reliability regarding th use suitable source ion concepts and str o problems and defeablems developed by	echniques for the s of reliability are tion security, and example, concepts, systems or reliable pics covered in the wledge; development and the tools used; s of information to strategies to given ategies to a given end their work; y others and check
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes			
Self-study time (in hours [h]):	120			
	Contact time	Supplementary ex (number, form, scop	am requirements	Course accompanying
Courses (teaching format)	For completion of module	For admission to module exam	module (partial) exam (s) (number, form, scope)	
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
Frequency of offer:		WiSe and SoSe		
Prerequiste:		None		
Department:		Digital Engineering		

HPI-CS-DSD: Dependable System	ns - Deep Dive		Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory election	ve module		
Content and qualification goals of the module:	Content: This module provi as well as current and operation of d Advanced scientif questions are incor- reliability: such a integrity. For exar- methods and tech distributed system Qualification goal The students acqu the module. Students: - gain further subj - expand their pro- practice discussion - acquire further ex- operation of system - are able to indepo- solve additional pro- can assess the a advanced problem - can present self- against critical obj - can critically qu and check their pro-	ides advanced scientif research questions ar ependable systems. The concepts, methods bluded for one or m s, availability, reliability, reliability, reliability, reliability, reliability, reliability, reliability, secure network system s, secure network system s, secure network system ire further knowledge ect-specific theoretical fessional judgment sk on skills and technique xperience in dealing v ms and aspects of relia- endently evaluate and roblems; applicability of solutions is; I apply suitable solutions ections; estion solutions deve of essional suitability.	fic concepts, method and results, regarding and techniques, an hore of the fundar lity, safety, informa- ls with advanced so research questions tems and high-avail about the specialist about the specialist about the specialist about the specialist ills; es; with reliability in the ability in terms of the use suitable sources ion concepts and stat to further problems loped by others for	ds and techniques, g the development d current research nental aspects of ation security and cientific concepts, for safety-critical ability systems. t topics covered in al knowledge; e development and he tools used; s of information to trategies to given rategies to a given and defend them turker problems
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes Oral exam 30 45 minutes			search results (20-
Self-study time (in hours [h]):	120			
	[
Courses (teaching format)	Kontakt- zeit (in SWS)	Supplementary ex (number, form, scop For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scoppe)
Project seminar/seminar/lecture	4	_	Exercises (at	-
(lecture or seminar)	т 	-	least 50%)	-
() () () () () () () () () ()		L		
Frequency of offer:		WiSe and SoSe		
Prerequiste:		Prior participation in	n HPI-CS-DSC is re	commended.
Department:		Digital Engineering		

HPI-CS-DSS: Dependable Systems - Specialization			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: This module provi as well as current and operation of d Advanced scientif questions are inc reliability: such as integrity. For exar methods and tech distributed system. Qualification goals The students acqui the module. Students: - gain further subje - expand their prof - practice discussio - acquire further ex- operation of system - are able to independ solve additional pr - can assess the a advanced problem - can present self- against critical obj - can critically qu and check their prof	des advanced scientif research questions ar ependable systems. ic concepts, methods luded for one or m s, availability, reliabi nple, the module dea iniques and current s, secure network sys s: ire further knowledge ect-specific theoretica fessional judgment sk on skills and technique perience in dealing w ns and aspects of reli endently evaluate and oblems; applicability of solut s; developed solutions ections; estion solutions deve ofessional suitability.	fic concepts, method and results, regarding and techniques, an hore of the fundar ility, safety, informa- ility, safety, informa- ils with advanced so research questions tems and high-avail about the specialist about th	ds and techniques, g the development d current research nental aspects of ation security and cientific concepts, for safety-critical ability systems. t topics covered in eal knowledge; e development and ne tools used; s of information to trategies to given rategies to a given and defend them c further problems
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 45 mins.) Written exam, 90- Oral exam, 30-45	pages, together with 120 minutes minutes	a presentation of rea	search results (20-
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form,
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
Frequency of offer:		WiSe and SoSe		
Prerequiste:		Prior participation in HPI-CS-DSC is recommended.		

HPI-CS-IGC: HCI and Graphics - Core			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: This module teach graphic systems and for visualizing geovisualization, a and computers usi Qualification goal The students acquir module. Students: - acquire subject-s - acquire subject-s - develop discussio - acquire experien of systems and, th - are able to indep solve problems; - can assess the a problems; - can select and a problem; - can present self- - can critically exa	es scientific concepts nd human computer in complex issues, su as well as novel conce ng different methods s: ire detailed knowledge pecific theoretical and fessional judgment co on skills and techniqu ce in handling reliabi ereby, the tools imple endently develop and applicability of solut apply suitable solution developed solutions to pro suitability.	, methods and techn nteraction. Participa ch as software ppts for the interaction and devices. e of the specialist top d methodological knowpetency; les; lity in the developm mented for aspects use suitable sources ion concepts and strate oproblems and defe- blems developed by	iques of computer ints learn concepts visualization and on between people pics covered in the nowledge; ment and operation of reliability; s of information to trategies to given ategies to a given end their work; y others and assess
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 45 mins.) Written exam, 90- Oral exam, 30-45	pages, together with 120 minutes minutes	a presentation of rea	search results (20-
Self-study time	120			
(in nours [h]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
	L	<u> </u>	10000 00709	<u> </u>
Frequency of offer:		WiSe and SoSe		
Prerequiste:		None		
Department:		Digital Engineering		

HPI-CS-IGD: HCI and Graphics - Deep Dive			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: The module teach computer graphic concepts for visua geovisualization, a computers using d Qualification goal The students acqu the module. Students: - acquire subject-s - expand their prof - develop discussio - acquire experien of systems and, th - are able to indep solve problems; - can assess the a problems; - can select and a problem; - can present self- - can critically exa their professional	es advanced scientific systems and humar alizing complex issue as well as novel conce- ifferent methods and s: ire further knowledge specific theoretical an- fessional judgment co- on skills and techniqu ce in handling reliabi ereby, the tools imple endently develop and applicability of solut apply suitable solution developed solutions to pro- suitability.	e concepts, methods in computer interact es, such as software epts for the interact devices are deepend e about the specialis d methodological knowpetency; les; lity in the developmented for aspects use suitable sources ion concepts and stra- problems and defe- blems developed by	and techniques of tion. In this way, visualization and ion of people with ed. t topics covered in nowledge; nent and operation of reliability; s of information to trategies to given ategies to a given end their work; y others and assess
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes			
Self-study time	120			
(in hours [h]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
	I	<u> </u>	100000000	
Frequency of offer:		WiSe and SoSe		
Prerequiste:		Prior participation in	n HPI-CS-IGC is re	commended.
Department:		Digital Engineering		

HPI-CS-IGS: HCI and Graphics - Specialization			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory election	ve module		
Content and qualification goals of the module:	Content: The module teach computer graphic concepts for visua geovisualization, a computers using d Qualification goal The students acqu the module. Students: - acquire subject-s - expand their prot - develop discussion - acquire experien of systems and, th - are able to indep solve problems; - can assess the a problems; - can select and a problem; - can present self- - can critically exat their professional	es advanced scientific systems and humar ilizing complex issue as well as novel conce ifferent methods and s: ire further knowledge pecific theoretical and fessional judgment co on skills and techniqu ce in handling reliabi ereby, the tools imple endently develop and applicability of solut upply suitable solution developed solutions to mine solutions to pro suitability.	concepts, methods computer interact s, such as software epts for the interact devices are deepend about the specialist d methodological kn mpetency; es; lity in the developm mented for aspects use suitable sources ion concepts and stra p problems and defe blems developed by	and techniques of tion. In this way, e visualization and ion of people with ed. t topics covered in nowledge; ment and operation of reliability; s of information to strategies to given ategies to a given end their work; y others and assess
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes Oral exam 30.45 minutes			
Self-study time	120			
(in hours [h]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at	-
(lecture or seminar)			10ast 3070)	
Frequency of offer:		WiSe and SoSe		
Prerequiste:		Prior participation in	n HPI-CS-IGC is re	commended.
Department:		Digital Engineering		

HPI-CS-IRP: Individual Research Project			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
	Content: This module deals research work car analyzed, and a sol constructively, in scientifically docu- strengths and wea with other solution understanding of extensive insights and participate in research project is Qualification goals Students improve area as well as the	with a selected, reservied out at the depart lution is designed for tegrated into the resourced. The soluti knesses. Through a ons, algorithms, or them in a theoretical into the current researced the development of n carried out by the stus: their methodological ir skills in scientific v	arch-related questio iment of supervisio a sub-area, which is search work of the ons are always ev comparative evalua systems, participar and practical sen rch work being done we solutions. Work adent as a single wo l skills within the work.	In from the current n. The question is then implemented e department and valuated for their tion of the results nts gain a deeper ise. Students gain e in the department c on the individual rk. respective subject
the module:	 Students: train their reading and understanding of current scientific literature on a topic; practice the practical implementation of their ideas into provable or measurable solutions in the context of a research project; further develop their ability to present findings and connections verbally and 			
	in writing; - deepen their ability to argue and evaluate in a balanced way; - gain in-depth insight into the current state of research. Students develop these skills through research-relevant content. By carrying out the project, students expand and (or) deepen the professional skills they already have. This means that students have ready-to-use experiential knowledge for carrying out even more extensive projects in a research context. To prepare for the project, students write an exposé (1 page max.) that contains the content, goals, and tasks, and the schedule of the project.			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 45 mins.) Paper (at least 12	pages, together with ogs.)	a presentation of re	search results (20-
Self-study time (in hours [h]):	120			
	1			1
	Contact time	Supplementary ex (number, form, scop	am requirements be)	Course accompanying
Courses (teaching format)	(in semester hours)	For completion of module	For admission to module exam	module (partial) exam (s) (number, form, scope)
Seminar (Seminar)	4	-	-	-
E 0.00		WP		
Frequency of offer:		W1Se and SoSe	1	1 1
Prerequiste:		Prior participation i	n at least two courd	rses in the subject
Department:		Digital Engineering	u.	

HPI-CS-ISC: Intelligent Systems - Core			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: This module teach the development languages (AI prop This includes cond artificial intelliger This module there machine learning, Qualification goal: The students acqui module. Students: - gain subject-spect - expand their prof - develop discussio - gain experience in decision-making artificial intelligen - are able to indept solve problems; - can assess the ap problem; - can select and a problems; - can present self- c can critically que their professional	es the basic scientific of intelligent dist gramming languages) cepts and methods for nee such as distribute efore deals with asp probabilistic methods s: re detailed knowledge cific theoretical and m fessional judgment sk on skills and techniqu in dealing with metho and optimization as ce and hardware-rela endently develop and pplicability of solution testion solutions to pro suitability.	concepts, methods ributed systems a , r one or more funda ed AI, accuracy, an ects such as distril and hardware-spec e of the specialist top hethodological know ills; les; ds of machine learn well as distribut ted programming; use suitable sources on concepts and str n concepts and str o problems and defe- blems developed by	and techniques for and programming amental aspects of ad fault tolerance. buted systems for ific AI algorithms. pics covered in the vledge; ing and automatic ed algorithms of s of information to ategies to a given ategies to a given end their work; y others and check
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 45 mins.) Written exam, 90- Oral exam, 30-45	pages, together with 120 minutes minutes	a presentation of re	search results (20-
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
		WG 100		
Prequency of offer:		WiSe and SoSe		
Prerequiste:		INONE Digital Engineering		
Department:		Digital Engineering		

HPI-CS-ISD: Intelligent Systems - Deep Dive			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory modu	ıle		
Content and qualification goals of the module:	 Content: This module teaches the basic scientific concepts, methods and techniques for the development of intelligent distributed systems and programming languages (AI programming languages). This includes concepts and methods for one or more fundamental aspects of artificial intelligence such as energy efficiency and programmability. This module also deals with aspects such as probabilistic programming and hardware-specific AI algorithms. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: gain subject-specific theoretical and methodological knowledge; expand their professional judgment skills; develop discussion skills and techniques; gain experience in dealing with methods of machine learning and automatic decision-making and optimization as well as distributed algorithms of artificial intelligence and hardware-related programming; are able to independently develop and use suitable sources of information to solve problems; can assess the applicability of solution concepts and strategies to given problem; can present self-developed solutions to problems and have the ability to defend their work; 			
	- can critically que their professional	estion solutions to pro suitability.	blems developed by	y others and check
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 45 mins.) Written exam, 90- Oral exam, 30-45	pages, together with 120 minutes minutes	a presentation of re	search results (20-
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
Frequency of offer:		WiSe and SoSe		
Prerequiste:		Prior participation in	n HPI-CS-ISC is rec	commended.
Department:		Digital Engineering		

HPI-CS-ISS: Intelligent Systems - Specialization			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module	, , , , , , , , , , , , , , , , ,	
Content and qualification goals of the module:	Content: This module teach the development languages (AI pro- This includes con- artificial intelliger module also deal hardware-specific Qualification goal The students acqui module. Students: - gain subject-spec - expand their pro- develop discussion- gain experience in decision-making artificial intelligen - are able to indep- solve problems; - can assess the aproblem; - can select and a problem; - can present self defend their work; - can critically que	es the basic scientific of intelligent distr gramming languages) cepts and methods for nee such as energy e s with aspects such AI algorithms. s: ire detailed knowledge effic theoretical and m fessional judgment sk on skills and techniqu in dealing with metho and optimization as ice and hardware-relatendently develop and applicability of solution developed solutions estion solutions to pro	concepts, methods a ributed systems a rone or more funda officiency and program as probabilistic p e of the specialist top methodological know ills; les; ds of machine learn well as distribut ted programming; use suitable sources ion concepts and s n concepts and strat to problems and h	and techniques for and programming amental aspects of rammability. This programming and pics covered in the vledge; ting and automatic ed algorithms of s of information to trategies to given ategies to a given have the ability to y others and check
Partial module exams (number, form, scope):	their professional suitability. Exam types: Paper of at least 8 pages, together with a presentation of research results (20-45 mins.) Written exam, 90-120 minutes Oral event 20, 45 minutes			search results (20-
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
Frequency of offer:		WiSe and SoSe		
Prerequiste:		Prior participation in	n HPI-CS-ISC is rec	commended.
Department:		Digital Engineering		

HPI-CS-LAB: Computer Science Lab		Number of credit points (CP): 12		
Module type (compulsory or compulsory elective module):	Compulsory modu	ıle		
Content and qualification goals of the module:	In the Computer Science Lab, students work together in a group on a selected, research-related question from a track in the degree program. The question is analyzed, and a solution is designed for a sub-area, which is then implemented constructively and scientifically documented. The solutions are always evaluated for their strengths and weaknesses. A practical understanding of them is deepened by a comparative evaluation with other solutions, algorithms, or systems. Students thereby gain deep insights into the current research work being conducted in the tracks and subject areas, as well as participating in the development of new solutions. Accordingly, activities in this module are assigned to specific tracks. This module deepens the students' scientific training. The lab activity takes place in project groups, usually with at least three and a maximum of six members each. University lecturers from the Digital Engineering Faculty suggest projects from their area of work, design their content and support the students in their implementation. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - gain subject-specific theoretical, methodological, and practical knowledge, - can select and apply suitable solution concepts and strategies to a given problem; - learn how to independently work on a topic on the basis of primary and secondary literature; - are able to independently access and evaluate scientific literature on individual topics; - gain skills in the area of project management by working in teams; - gain skills in the area of project management by working in teams; - gain sovereignty in the collaborative and divisional processing of tasks;			
Partial module exams (number,	Exam types:			
form, scope):	Paper of at least 12 30-45 mins.)	2 pages, together with	a presentation of res	search results (talk,
Self-study time (in hours [h]):	240			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project activity (project)	8	-	-	-
	1	1	1	·
Frequency of offer:		WiSe and SoSe		
Prerequiste:		Prior successful participation in the modules intended as a prerequisite for the respective project activity is recommended.		
Department:		Digital Engineering		

HPI-CS-LSA: Large-Scale Systems Architectures		Number of credit points (CP): 6		
Module type (compulsory or compulsory elective module):	Compulsory modu	lle/compulsory electiv	ve module	
Content and qualification goals of the module:	A characteristic development in computer science is the trend towards ever larger problems that require ever larger systems. Classic examples are web search engines or video streaming farms; a modern example is the training of large machine learning models. Such applications require a corresponding infrastructure that must be efficient in several aspects (e.g., investment and operating costs, energy, administration effort, development effort). This module primarily looks at such infrastructures from a technological perspective. A secondary view examines aspects of software development that are relevant for large applications on large infrastructures. Technological aspects begin with the system architecture of an individual system (e.g., addressing the question of why GPUs are relevant for typical ML applications), address the structure of a data center, and then questions of the management and operation of a cloud system. All phases of a life cycle from project planning, design, investment decisions, and operation are covered for both perspectives. Aspects such as robustness or energy efficiency are also taken into account. Qualification goals: Students acquire detailed knowledge and advanced skills in the specialist topics covered in the module. Students: - gain advanced, subject-specific, theoretical and methodological knowledge; - acquire basic experience in dealing with the development and operation of systems and the techniques, challenges and tools used; - are able to independently develop and use suitable sources of information to solve basic problems; - can assess the applicability of solution concepts and strategies to given basic problems; - can present self-developed solutions to advanced problems and have the ability to defend their work;			
Partial module exams (number,	Exam types: Written exam 90-	120 minutes		
form, scope):	Oral exam, 30-45	minutes		
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at	-
(lecture or seminar)			least 50%)	
Frequency of offer		WiSe		
Prerequiste:		None		
Department:		Digital Engineering		

HPI-CS-ML: Machine Learning	g Number of credit points (CP): 6			
Module type (compulsory or compulsory elective module):	Compulsory modu	ile/compulsory electiv	ve module	
Content and qualification goals of the module:	Contents: This module teaches the basics of machine learning and artificial intelligence. Content includes machine learning methods as well as practical use cases in digital health, such as classification, distributed learning, predictive modeling, and transparent methods. Methods for validating machine learning procedures are covered. Emphasis is further placed on the preprocessing of data required for machine learning, such as data cleaning, feature extraction and selection. After completing the module, students should be able to find and implement innovative problem solutions using machine learning. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - learn concepts and methods; - master the basics of machine learning and artificial intelligence in the context of digital health; - learn relevant machine learning algorithms and techniques that can be applied in digital health to develop medical diagnoses, prognosis, and decision support systems; - are able to collect, clean, and prepare data for healthcare machine learning to create high quality models; - can develop, train and evaluate models for machine learning in healthcare.			
Partial module exams (number, form, scope):	Exam types: Written exam, 90- Oral exam, 30-45	120 minutes minutes		
Self-study time (in hours [h]):	120			
	Contact time	Supplementary exam requirements (number, form, scope)		Course accompanying
Courses (teaching format)	(in semester hours)	For completion of module	For admission to module exam	module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (50%)	-
Frequency of offer:		SoSe		
Prerequiste: Nor		None		
Department:		Digital Engineering		

HPI-CS-MLC: Machine Learning - Core		Number of credit points (CP): 6		
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: This module teacl areas of machine I decision trees, cor- that range from learning. It forges learning to progra energy-efficient h module focuses on of the data. Stud paradigms of mac provided in lectu machine learning a Qualification goal The students acqui module. Students: - understand the r stochastics, statistic computer architect - are versed in met methods (e.g., gra- - can assess these r derive, expand, an - have gained expe- know which prol - have gained ins research projects a	hes basic methods an earning using non-pr e algorithms, and logi regression, classifica the link from matho- umming languages, p ardware for modern distributed methods to ents gain an in-dept hine learning. A prace ure-accompanying p algorithms in exercises re detailed knowledge necessity of mathema- tics, as well as the nee- ture, distributed system hods for analyzing lea- dient methods); nethods in terms of th d adapt them on a for erience in dealing with blems are the research sights into current sta- nd into the current sta-	d concepts related obabilistic methods cal programming) in ttion, and ranking ematical modeling rogramming langua machine learning. that scale with the si th, formal understa- tical understanding rogramming tasks es. e of the specialist top tical concepts such d for system-related ns and programmin ming algorithms su eir effectiveness an mal level; h machine learning focus of machine l obution approaches ate of research.	to research in the (neural networks, n application areas to reinforcement and the theory of age concepts, and Furthermore, this ze and complexity anding of various of the methods is and projects of pics covered in the as linear algebra, d concepts such as g language theory; ich as optimization d applicability and systems and tools; earning; in industrial and
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 45 mins.) Written exam, 90- Oral exam, 30-45	pages, together with 120 minutes minutes	a presentation of re	search results (20-
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
Frequency of offer:		WiSe and SoSe		
Prerequiste:		None		
Department:		Digital Engineering		

HPI-CS-MLD: Machine Learning - Deep Dive			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electric	ve module		
Content and qualification goals of the module:	Content: This module teach areas of machine l decision trees, cor- that range from learning. It forges learning to progra- energy-efficient h module focuses or of the data. Stud paradigms of mac provided in lectr machine learning a Qualification goal The students acqui module. Students: - understand the r stochastics, statist computer architect - are versed in met methods (e.g., gra - can assess these r derive, expand, an - have gained expe - know which prol	hes basic methods an learning using non-pr e algorithms, and logi regression, classifica s the link from math amming languages, p ardware for modern distributed methods ents gain an in-dep hine learning. A prace ure-accompanying p algorithms in exercise s: ire detailed knowledg necessity of mathema ics, as well as the nece ture, distributed syster hods for analyzing lead dient methods); nethods in terms of th d adapt them on a for erience in dealing wit olems are the research sights into current so	ad concepts related obabilistic methods cal programming) in ation, and ranking ematical modeling programming langu machine learning. that scale with the si th, formal understa- tical understanding rogramming tasks es. e of the specialist to tical concepts such at for system-related ms and programmin arning algorithms su their effectiveness an smal level; h machine learning a focus of machine learning a focus of machine learning bolution approaches	to research in the c (neural networks, n application areas to reinforcement and the theory of age concepts, and Furthermore, this ize and complexity anding of various of the methods is and projects of pics covered in the as linear algebra, d concepts such as g language theory; ich as optimization d applicability and systems and tools; learning; in industrial and
Partial module exams (number, form, scope):	research projects and into the current state of research. Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes Oral exam 30-45 minutes			search results (20-
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
		1		
Frequency of offer::		WiSe and SoSe		
Prerequiste:		Prior participation in	n HPI-CS-MLC is r	ecommended.
Department:		Digital Engineering		

HPI-CS-MLS: Machine Learning - Specialization			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module	X .	
Content and qualification goals of the module:	Content: This module teaches basic methods and concepts related to research in the areas of machine learning using non-probabilistic methods (neural networks, decision trees, core algorithms, and logical programming) in application areas that range from regression, classification, and ranking to reinforcement learning. It forges the link from mathematical modeling and the theory of learning to programming languages, programming language concepts, and energy-efficient hardware for modern machine learning. Furthermore, this module focuses on distributed methods that scale with the size and complexity of the data. Students gain an in-depth, formal understanding of various paradigms of machine learning. A practical understanding of the methods is provided in lecture-accompanying programming tasks and projects of machine learning algorithms in exercises. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - understand the necessity of mathematical concepts such as linear algebra,			
	 - understand the necessity of mathematical concepts such as linear algebra, stochastics, statistics, as well as the need for system-related concepts such as computer architecture, distributed systems and programming language theory; - are versed in methods for analyzing learning algorithms such as optimization methods (e.g., gradient methods); - can assess these methods in terms of their effectiveness and applicability and derive, expand, and adapt them on a formal level; - have gained experience in dealing with machine learning systems and tools; - know which problems are the research focus of machine learning; - can analyze the current solution approaches in industrial and research projects and evaluate the current state of research. 			
Partial module exams (number, form, scope):	Paper of at least 8 45 mins.) Written exam, 90- Oral exam, 30-45	pages, together with 120 minutes minutes	a presentation of re	search results (20-
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
		W'a ta a		
Frequency of offer:		WiSe and SoSe		
Prerequiste:		Prior participation in	n HPI-CS-MLC is r	ecommended.
Department:		Digital Engineering		

HPI-CS-MMC: Mathematical Modelling - Core			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	 This module provides advanced knowledge of various mathematical models, especially stochastic and statistical models, as well as their in-depth application in various areas of computer science. Common and currently used models are examined and analyzed in greater detail. More advanced, specialized problems are discussed and techniques and algorithms for solving them are taught. Students: have gained a comprehensive understanding of the properties of various advanced mathematical modeling; can analyze and evaluate complex techniques and algorithms based on the mathematical models used; are able to analyze advanced models at a theoretical level and extract structural properties using the appropriate analysis techniques; have gained in-depth subject-specific theoretical, methodological and practical knowledge; can independently develop and use suitable sources of information to solve further problems; know which specialized problems exist in the field of mathematical modeling and are currently open; have in-depth insight into current solutions in industry and research. 			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes Oral exam, 30-45 minutes			
Self-study time	120			
(in hours [h]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at	-
(lecture or seminar)			least 50%)	
Frequency of offer		Wise and Sasa		
Prerequiste:		None		
Department:		Digital Engineering		

HPI-CS-MMD: Mathematical Modelling - Deep Di		ve	Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: This module provi especially stocha application in vari- models are exam specialized proble them are taught. Qualification goal The students acqui module. Students: - have gained a c advanced mathem - can analyze and mathematical mod - are able to ana structural propertie - have gained in practical knowled - can independent further problems; - know which sp modeling and are - have in-depth ins	ides advanced knowle stic and statistical ous areas of computer nined and analyzed ms are discussed and s: ire detailed knowledge comprehensive unders atical modeling; evaluate complex tec lels used; lyze advanced mode es using the appropria n-depth subject-speci ge; ly develop and use su pecialized problems currently open; sight into current solu	edge of various mat models, as well science. Common in greater detail. techniques and algo e of the specialist to standing of the pro- chniques and algori its at a theoretical the analysis technique fic theoretical, mo- itable sources of in exist in the field tions in industry an	hematical models, as their in-depth and currently used More advanced, orithms for solving pics covered in the operties of various thms based on the level and extract us; ethodological and formation to solve of mathematical d research.
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes			
Self-study time	120			
(in hours [h]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop	am requirements e)	Course accompanying module (partial) exam (s)
	, 	module	module exam	(number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at least 50%)	-
(lecture or seminar)		1	least 50%)	1
Frequency of offer		WiSe and SoSe		
Prerequiste:		Prior participation in	HPI-CS-MMC is	recommended
Department:		Digital Engineering		eesminimudu.

HPI-CS-MMS: Mathematical Mo	ation	Number of (CP): 6	credit points	
Module type (compulsory or compulsory elective module):	Compulsory modu	lle	· · · · ·	
Content and qualification goals of the module:	 This module provides advanced knowledge of various mathematical models, especially stochastic and statistical models, as well as their in-depth application in various areas of computer science. Common and currently used models are examined and analyzed in greater detail. More advanced, specialized problems are discussed and techniques and algorithms for solving them are taught. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: have gained a comprehensive understanding of the properties of various advanced mathematical modeling; can analyze and evaluate complex techniques and algorithms based on the mathematical models used; are able to analyze advanced models at a theoretical level and extract structural properties using the appropriate analysis techniques; have gained in-depth subject-specific theoretical, methodological and practical knowledge; can independently develop and use suitable sources of information to solve further problems; know which specialized problems exist in the field of mathematical modeling and are currently open; have in-depth insight into current solutions in industry and research. 			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes			
Self-study time	120			
(in hours [h]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at	-
(lecture or seminar)			1east 50%)	
Frequency of offer::		WiSe and SoSe		
Prerequiste:		Prior participation in HPI-CS-MMC is recommended		
Department:		Digital Engineering		

HPI-CS-PMC: Probabilistic Mac	ore	Number of (CP): 6	credit points	
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	 Modeling relationships between data objects using probabilistic methods makes it possible to derive predictions and make statements about their reliability. This is the basis for probabilistic and statistical learning methods. The focus of this module lies on bridging the gap between advanced theoretical concepts and application to real data, while taking scalability into account. Students consider, among others, Bayesian learning methods, graphical models, Markovian decision-making processes, and advanced statistical learning algorithms. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: learn advanced concepts and methods, for example in the areas of probabilistic modeling and statistical learning; are able to evaluate necessary preconditions and assumptions and check these on existing data; can select and apply suitable solution concepts and strategies to a given complex problem; are able to independently evaluate and use suitable sources of information to solve complex problems; acquire further technical language knowledge; expand their learning skills. 			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes Oral exam, 30-45 minutes			search results (20-
Self-study time	120			
(in nours [n]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop) For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form,
Device transminer / lastres	4		Examinan (at	scope)
(lecture or seminar)	-	-	least 50%)	-
	1	1		1
Frequency of offer:		WiSe and SoSe		
Prerequiste:		None		
Department:		Digital Engineering		

HPI-CS-PMD: Probabilistic Machine Learning - D		eep Dive	Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: Modeling relation makes it possible reliability. This is The focus of thi theoretical concep account. Students graphical models, statistical learning Qualification goals The students acqui module. Students: - learn advanced probabilistic mode - are able to eval these on existing of - can select and a complex problem; - can evaluate and - expand their prof - acquire further te - expand their lear	aships between data to derive prediction the basis for probabi s module lies on b ts and application to consider, among Markovian decision algorithms. s: the detailed knowledge concepts and metheling and statistical lea uate necessary preco- lata; upply suitable solution implement the learner fessional judgment sk endently evaluate and blems; cchnical language knowling skills	objects using prob ns and make stater listic and statistical oridging the gap b real data, while taking others, Bayesian 1 on-making processed e of the specialist to mods, for example arning; anditions and assument on concepts and strated arrocedures in terri- ills; use suitable sources owledge;	babilistic methods ments about their learning methods. between advanced ing scalability into earning methods, es, and advanced pics covered in the in the areas of aptions and check ategies to a given ms of software; s of information to
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes Oral exam 30-45 minutes			
Self-study time	120			
(m nours [n]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at	-
(lecture or seminar)			least 50%)	
Frequency of offer		Wise and Sasa		
Prerequiste:		Prior participation is	HDLCS DMC in m	ecommended
Department:		Digital Engineering		
Department.		Digital Engineering		

HPI-CS-PMS: Probabilistic Mac	hine Learning - Sp	ecialization	Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: Modeling relation makes it possible reliability. This is The focus of thi theoretical concep account. Students graphical models, statistical learning Qualification goal. The students acqui module. Students: - learn advanced probabilistic mode - are able to eval these on existing of - can select and a complex problem; - can evaluate and - expand their prof - are able to indepo solve complex pro - acquire further te - expand their lear	ships between data to derive prediction the basis for probabil s module lies on b ts and application to p consider, among o Markovian decisio algorithms. re detailed knowledge concepts and mether ling and statistical lea uate necessary preco- lata; pply suitable solutio implement the learne fessional judgment sk endently evaluate and blems; connical language kno-	objects using prob ns and make staten istic and statistical ridging the gap b real data, while taki others, Bayesian 1 n-making processe e of the specialist top nods, for example arning; nditions and assum n concepts and stra d procedures in terr ills; use suitable sources wledge;	babilistic methods ments about their learning methods. etween advanced ng scalability into earning methods, es, and advanced pics covered in the in the areas of aptions and check ategies to a given ms of software; s of information to
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes Oral exam. 30-45 minutes			
Self-study time	120			
(in hours [h]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex. (number, form, scop) For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form,
Project seminar/seminar/lecture	4	-	Exercises (at	scope)
(lecture or seminar)	·		least 50%)	
Frequency of offer:		WiSe and SoSe		
Prerequiste:		Prior participation in	h HPI-CS-PMC is re	ecommended.
Department:		Digital Engineering		

HPI-CS-PSC: Provable Security - Core			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory election	ve module		
Content and qualification goals of the module:	Contents: This module teach complex systems algorithms (e.g., cryptographic has various methods discussed. Qualification goal The students acqui module. Students: - have a compi- cryptographic prin- - can assess the si- cryptographic algo- are able to desig the appropriate cry- - have gained si- knowledge; - can independent problems; - know which prol- have insight int projects and into t	tes various cryptograp and protocols. Comm asymmetric and h functions) are exa of cryptanalysis and s: ire detailed knowledge rehensive understand nitives; security of complex orithms used and iden n secure systems and yptographic primitive ubject-specific theore ly develop and use su plems are currently op to current solution ag	whic primitives and the non and currently us symmetric cryptog mined in greater of their mathematica e of the specialist top ling of the proper- systems and proto- tify vulnerabilities; protocols at a theo s; etical, methodologi itable sources of in- ben in the field of cr pproaches in indus earch.	their correct use in ised cryptographic graphic methods, letail. In addition, il foundations are pics covered in the erties of various cols based on the pretical level using ical and practical formation to solve yptography; trial and research
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes			
Self-study time	120			
(in hours [h]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
	I	I		
Frequency of offer:		WiSe and SoSe		
Prerequiste:		None		
Department:		Digital Engineering		

HPI-CS-PSD: Provable Security	- Deep Dive		Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Contents: This module pro- attention is paid to real-world applica fundamental resul knowledge proo- cryptography. Qualification goal. The students acqui module. Students: - can independent primitives; - can analyze given and prove their co - are versed in kn given protocols fo - are versed in cur develop an awarer - are able to con decision-makers in	wides in-depth know o the design and anal- ations. It provides the field, such fs, elliptic curve s: ire detailed knowledge h and self-developed of rrectness; nown attack methods r them; rent research trends a ness of the challenges mmunicate complex n an understandable n	wledge of cryptog lysis of provable se an expanded unde a as homomorphic cryptography, ar e of the specialist top cryptographic proto cryptographic primit and vulnerabilities nd developments in and opportunities in theoretical concep nanner.	graphy. Particular cure protocols for erstanding of the encryption, zero- nd post-quantum pics covered in the ecols from learned tives and protocols and can examine cryptography and n this area; ts and results to
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes Oral exam, 30-45 minutes			
Self-study time	120			
(in hours [h]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form,
	1			scope)
(lecture or seminar)	4	-	Least 50%)	-
			ieust 5070)	
Frequency of offer:		WiSe and SoSe		
Prerequiste:		Prior participation in	n HPI-CS-PSC is re	commended.
Department:		Digital Engineering	<u></u>	

HPI-CS-PSS: Provable Security - Specialization			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	This module provides in-depth knowledge of cryptography. Particular attention is paid to the design and analysis of provable secure protocols for real-world applications. It provides an expanded understanding of the fundamental results of the field, such as homomorphic encryption, zero- knowledge proofs, elliptic curve cryptography, and post-quantum cryptography. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - can independently develop complex cryptographic protocols from learned primitives; - can analyze given and self-developed cryptographic primitives and protocols and prove their correctness; - are versed in known attack methods and vulnerabilities and can examine given protocols for them; - are versed in current research trends and developments in cryptography and develop an awareness of the challenges and opportunities in this area; - are able to communicate complex theoretical concepts and results to decision-makers in an understandable manner.			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes Oral exam, 30,45 minutes			
Self-study time	120			
(in hours [h]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scoppe)
Project seminar/seminar/ lecture	4	-	Exercises (at	-
(lecture or seminar)			least 50%)	
Frequency of offer:		WiSe and SoSe		
Prerequiste:		Prior participation in	n HPI-CS-PSC is re	commended.
Department:		Digital Engineering		

HPI-CS-RE: Research Methods & Ethics			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory modu	ıle		
Content and qualification goals of the module:	Contents: This module deals with selected topics from the areas of epistemology, philosophy of science, and ethics, each with a connection to computer science. The focus here is on scientific practice, such as data use, scientific institutions (conferences, journals, peer reviews, citations, etc.), guidelines for good scientific practice, topic identification, experiment design, evaluation, and presentation. Qualification goals: The students improve their methodological skills at a research level. Students: - gain knowledge of the institutions of modern science and how they interconnect; - understand ethical problems related to scientific activity; - develop their skills related to scientific methods, for example experiments; - deepen their ability to express arguments in written and graphical form; - gain insight into modern scientific architecture.			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Paper (at least 12 pgs.)			
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Lecture or seminar (lecture or seminar)	4	-	Interim presentation (15 min.)	-
Frequency of offer: Prerequiste: Department:		WiSe and SoSe None Digital Engineering		

HPI-CS-S: Network Security	Number of credit points (CP): 6			
Module type (compulsory or compulsory elective module):	Compulsory modu	lle/compulsory electiv	ve module	
Content and qualification goals of the module:	Contents: An increasing nun networked infras characteristics of categorize attack v in design principle communication sy layer. In this wa concepts and mea for specific attack Qualification goal The students acqui module. Students: - familiarize thems common systems - are able to indep methods at a theor - evaluate describ attacks; - gain experience analyze security n - know which pr relevant and curre - gain insights in projects and into t	aber of attacks attemp tructures. This mo different systems an vectors or potential vues, security mechanism stems—from the data y, it is possible to sures, as well as to ex- vectors. s: and networks, as well bendently analyze sys- tetical level and identified security measures in dealing with systeme neasures and identify poblems in the area of ntly open; to current solution a he current state of res	t to compromise ind dule first looks d networks in orde ilnerabilities. Stude ms and vulnerabiliti a transmission layer consider various th camine their practic e of the specialist top haracteristics and se as potential vulner items and networks ify potential attack vec in the context of v ms and tools that m potential attack vec of systems and net pproaches in indus earch.	lividual systems or at the relevant er to identify and nts become versed les of network and to the application neoretical security al implementation pics covered in the ecurity concepts of abilities; using appropriate vectors; various threats and nake it possible to tors; work security are trial and research
Partial module exams (number, form, scope):	Exam types: Written exam, 90- Oral exam, 30-45	120 minutes minutes		
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
	1	1	/	·
Frequency of offer:		WiSe		
Prerequiste:		None		
Department:		Digital Engineering		

HPI-CS-SDC: Systems Development Techniques and Tools - Core Number of credit points (CP): 6				
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: The module include - Deepening of functional, logical, - Deepening of it implementation, m - Design, implem (high-level) progra - Design, imple environments for u - Expansion, use a self-sustaining sys - Design, implem iterative, explorate and maintenance a Qualification goals The students acqui module. Students: - acquire subject expand their prof discussion skills an - gain experience and the techniquess - are able to indepo solve problems; - can assess the a fundamental probl - can select and a problem; - can present self against critical obj - can critically que	les: basic programming , or imperative, dec erative, exploratory, naintenance, and asses entation, application amming languages mentation, application inversal and (domain and assessment of pro- tems entation, application ory, user-oriented tea nd assessment. s: re detailed knowledge -specific theoretical essional judgment sl nd the associated disc in dealing with the de c, challenges and tools endently develop and applicability of soluti ems; apply suitable solution -developed solutions ections; estion solutions to pro- mitability.	g paradigms (e.g. clarative, prompt-ba user-oriented techn ssment and assessment of on and assessment of on and assessment of chniques for design and assessment of chniques for design e of the specialist top and methodologic kills as well as the ussion techniques; evelopment and oper s used; use suitable sources ion concepts and stra- to problems and oper blems developed by	, object-oriented, ised,) niques for design, f domain-specific ent of execution ming languages endlessly running, f tools to support n, implementation pics covered in the cal knowledge to e development of eration of systems s of information to trategies to given ategies to a given defend their work y others and check
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 45 mins.) Written exam, 90- Oral exam, 30-45	pages, together with 120 minutes minutes	a presentation of rea	search results (20-
Self-study time (in hours [h]):	120			
	Contact time	Supplementary ex (number, form, scop	am requirements e)	Course accompanying
Courses (teaching format) (in sen hours)	(in semester hours)	For completion of module	For admission to module exam	exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
Frequency of offer:		WiSe and SoSe		
Prerequiste:		None		
Department:		Digital Engineering		

HPI-CS-SDD: Systems Development Techniques and Tools - DeepNumber of credit pointsDive(CP): 6				credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Compulsory electi Content: The module coverse emphasis on pro- paradigms/language prevalent compror- in detail; their con- historical context of The module include - Deepening of functional, logical - Deepening of it implementation/m - Design, implementation/m - Design, implementation/m - Design, implementation/m Qualification goals The students acquire module. Students: - acquire subject expand their profindiscussion skills an - gain experience and the techniquess - are able to indeposed solve problems; - can assess the a fundamental probl- - can select and an	s further aspects from oblems that require ges/systems/tools/use nises of modern paraco ore ideas are isolated using scientific metho des: basic programming , or imperative, dec cerative, exploratory, aintenance and assess mentation, application amming languages ementation, application or terms tentation, applica	the following subje e a deeper unde cases covered digms/languages/syst l and classified into ods. g paradigms (e.g. clarative, prompt-bauser-oriented technisment and assessment of ion and assessment of ion and assessment of the specific programm ogrammable, partly and assessment of techniques sment. e of the specialist to and methodologic kills as well as the cussion techniques; evelopment and op s used; use suitable sources ion concepts and str	ct areas and places rstanding of the d. Furthermore, stems are analyzed to the appropriate , object-oriented, used,) niques for design, of domain-specific ent of execution ming languages endlessly running, f tools to support for design, pics covered in the cal knowledge to e development of eration of systems s of information to strategies to given ategies to a given
	 problem; - can present self-developed solutions to problems and defend their work against critical objections; - can critically question solutions to problems developed by others and check their professional suitability. 			
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes Oral exam, 30-45 minutes			
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-

Frequency of offer:	WiSe and SoSe
Prerequiste:	Prior participation in HPI-CS-SDC is recommended.
Department:	Digital Engineering

HPI-CS-SDO: Systems Development and Operation		15	Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory modu	lle/compulsory electiv	ve module	
Content and qualification goals of the module:	Content: The module teacher one or more funda IT systems. These oriented IT system topics, this modul for the manual, decisions during di- can be presented th or techniques for example. Qualification Goal Qualification Goal Qualification Goal Qualification Goal Qualification Goal Qualification Goal Qualification Goal Qualification goal The students acqui module. Students: - gain advanced su - expand their prof - develop discussis - acquire basic exp systems and the to - develop and use fundamental probl - assess the app fundamental probl - acquire the abi strategies to a give - present self-dev against critical obj - can critically que	es advanced scientific mental aspects of the include, for example, s, domain models, arc e focuses on advance semi-automatic, or evelopment or adapta nrough methods and to easily adaptable sy ls: s: re detailed knowledge bject-specific theoret fessional judgment sk on skills and techniqu perience in dealing w ols used; e suitable sources of ems; licability of solution ems; lity to select and a en advanced problem; eloped solutions to advanced stations;	concepts, methods design, developmer requirements for IT chitectures, and vari ed concepts, method automatic conside tion decisions durin echniques of proces stems or self-adap e of the specialist top ical and methodolog ills; es; ith the developmen information to inconstant pply suitable solut advanced problems de	and techniques for nt and operation of 'systems, process- ants. Among other ds, and techniques eration of design g operation. These s mining, methods otive systems, for pics covered in the gical knowledge; t and operation of dependently solve rategies to given ion concepts and and defend them eveloped by others
Partial module exams (number, form, scope):	Exam types: Written exam, 90- Oral exam, 30-45	120 minutes minutes		
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
Frequency of offer:		SoSe		
Prerequiste:		None Digital Engineering		

HPI-CS-SDS: Systems Developm Specialization	ent Techniques an	d Tools -	Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	 subject areas. In doing so, it places emphasis on problems that require a deep understanding of the paradigms/languages/systems/tools/use cases cover Furthermore, prevalent compromises of mode paradigms/languages/systems are analyzed in detail, their core ideas isolated and classified into the appropriate historical context using scientimethods. Deepening of basic programming paradigms (e.g., object-orient functional, logical, or imperative, declarative, prompt-based,) Deepening and specializing in iterative, exploratory, user-orient techniques for design, implementation/maintenance and assessment Design, implementation, application and assessment of domain-speci (high-level) languages Further design, implementation, application and assessment of specializ execution environments for universal and (domain) specific programma languages Expansion, use and assessment of programmable, sometimes endles running, self-sustaining complex systems Design, implementation, application and assessment of specialized tools support iterative, exploratory, user-oriented techniques for desig implementation/maintenance and assessment. Qualification goals: The students acquire further and in-depth knowledge of the specialist top covered in the module. Students: gain detailed, in-depth subject-specific theoretical and methodologi knowledge to expand their professional judgment skills as well as application of discussion skills and associated discussion techniques; deepen and expand experience in the development and operation of system and the techniques, challenges and tools used; evaluate and independently use appropriate sources of information to so complex problems; acquire the ability of specialized problem; acquire the ability to evaluate and apply suitable solution concepts a strategies to a given complex, specialized problem; 			rom the following nat require a deeper use cases covered. of modern eir core ideas are ext using scientific , object-oriented, used,) ory, user-oriented sessment f domain-specific ent of specialized diffic programming netimes endlessly pecialized tools to ues for design, he specialist topics d methodological s as well as the echniques; eration of systems formation to solve and strategies for tion concepts and problems and have
Partial module exams (number, form, scope):	 - can critically question solutions to complex problems developed by others and check their professional suitability. Exam types: Paper of at least 8 pages, together with a presentation of research results (20-45 mins.) Written exam 90-120 minutes 			
Self-study time	Oral exam, 30-45	minutes		
(in nours [h]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary exa (number, form, scop For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-

Frequency of offer:	WiSe and SoSe
Prerequiste:	Prior participation in HPI-CS-SDC is recommended.
Department:	Digital Engineering

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HPI-CS-SIC: Systems Infrastruc	ture - Core	Number of credit points (CP): 6		
Module type (compulsory or compulsory elective module):	Compulsory election	ve module		
	Content: This module add perspective. The architectures. Tecl levels are emphas computer and its ir to distributed and r in the bachelor's de treatment is deepe proofs in system c with a greater em levels. - Deepening of functional, logical.	resses a system's core aspects from focus is on different sub-areas of la hnical and technological interactions at ized. This can range from the consider aternal architecture, to operating systems betworked systems. In comparison to corre- egree programs, the thematic demands he r in terms of subject matter (e.g., by inconsiderations), and the approach is mor- phasis on cross-relationships between basic programming paradigms (e.g., or imperative, declarative, prompt-ba	a technological arge-scale system t different system ration of a single and virtualization, esponding courses ere are higher, the cluding optimality re comprehensive, individual system , object-oriented, sed,)	
	 Deepening and techniques for desi Design, implem (high-level) langua Further design, i execution environ languages 	d specializing in iterative, explorato gn, implementation/maintenance and ass entation, application and assessment o ages mplementation, application and assessm ments for universal and (domain) spec	ry, user-oriented essment f domain-specific ent of specialized ific programming	
Content and qualification goals of the module:	 als of Expansion, use and assessment of programmable, sometimes end running, self-sustaining complex systems Design, implementation, application and assessment of specialized to support iterative, exploratory, user-oriented techniques for d implementation/maintenance and assessment. Qualification goals: 			
	The students acqui covered in the mod Students: - gain in-depth and knowledge to exp application of disc - deepen and expa operation of syster - evaluate and use complex problems - assess the applic given complex pro - evaluate and ap complex, specializ - can present self- have the ability to - can critically que and check their pro	ire further and in-depth knowledge of the dule. In dule their subject-specific theoretical and band their professional judgment skill ussion skills and associated discussion te and their experience in dealing with the ns and the techniques, challenges and too appropriate sources of information to in- ; ability of specialized solution concepts blems; ply suitable solution concepts and strated problem; developed solutions to complex, specialid defend their work; estion solutions to complex problems de prostate solution solutions to complex problems de proster solutions to complex problems de proster solutions to complex problems de proster solutions to complex problems de	e specialist topics d methodological s as well as the chniques; development and ols used; dependently solve and strategies for tegies to a given zed problems and veloped by others	
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes Oral exam 30-45 minutes			
Selbstlernzeit (in Zeitstunden (h)):	120			
Courses (teaching format)	Contact time (in semester	Supplementary exam requirements (number, form, scope)	Course accompanying	

	hours)	For completion of module	For admission to module exam	module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at	-
			Teast 5076)	
Frequency of offer:		WiSe and SoSe		
Prerequiste: None				
Department:		Digital Engineering		

HPI-CS-SID: Systems Infrastructure - Deep Dive			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: In this module, technological pers sub-areas of large- technical and tech range from the con to operating system Qualification goals The students acqu covered in the mod Students: - gain in-depth, a knowledge to exp application of disc - deepen and exp operation of system - acquire the abilit information to solv - can assess the ap for given complex - can evaluate and complex, specializ - can present self- have the ability to - can critically que	technical sub-areas pective with a high le scale systems architec nological relationship sideration of a single ns and virtualization, s: ire further and in-dep dule. advanced subject-spe pand their professio ussion skills and the pand experience in ns and the techniques y to independently ev ve complex problems oplicability of specia problems; apply suitable solutions ted problem; developed solutions to constant and their work; estion solutions to co	of a system are vel of detail. The fo ctures. Emphasis is p os at different system computer and its into to distributed and no oth knowledge of th cific theoretical an nal judgment skill associated discussion dealing with the s, challenges and too valuate and use appri- j lized solution conce on concepts and str to complex, speciali- mplex problems de	e treated from a placed on complex m levels. This can ternal architecture, etworked systems. The specialist topics and methodological s as well as the on techniques; development and ols used; ropriate sources of epts and strategies rategies to a given ized problems and eveloped by others
Partial module exams (number, form, scope):	and check their professional suitability. Exam types: Paper of at least 8 pages, together with a presentation of research results (20-45 mins.) Written exam, 90-120 minutes Quark			
Self-study time	120			
(in hours [h]):				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
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Frequency of offer:		WiSe and SoSe		
Prerequiste:		Prior participation recommended.	in HPI-CS-LSA o	or HPI-CS-SIC is
Department:		Digital Engineering		

HPI-CS-SIS: Systems Infrastructure - Specialization		n	Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: In this module, technological pers sub-areas of large- technical and tech range from the cor to operating syster Qualification goal The students acqu covered in the mod Students: - gain in-depth, a knowledge to ex application of disc - deepen and ex operation of syster - acquire the abiliti information to solu- - can assess the ap for given complex - can present self- have the ability to	technical sub-areas pective with a high le scale systems architec nological relationship sideration of a single ns and virtualization, s: ire further and in-dep dule. advanced subject-spe pand their professio ussion skills and the pand experience in ns and the techniques y to independently ev ve complex problems oplicability of specia problems; apply suitable solutions to defend their work:	of a system are vel of detail. The fo ctures. Emphasis is j os at different system computer and its int to distributed and n oth knowledge of th cific theoretical and nal judgment skill associated discussion dealing with the s, challenges and too valuate and use appri- j lized solution concer- on concepts and stra- to complex, speciality	e treated from a pocus is on different placed on complex m levels. This can ternal architecture, etworked systems. The specialist topics and methodological as as well as the on techniques; development and ols used; ropriate sources of epts and strategies rategies to a given ized problems and
	- can critically qu	estion solutions to co	mplex problems de	eveloped by others
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.) Written exam, 90-120 minutes			
Self-study time	120			
(in hours [h]):				
	Contact time	Supplementary exam requirements (number, form, scope)		Course accompanying
Courses (teaching format)	(in semester hours)	For completion of module	For admission to module exam	module (partial) exam (s) (number, form, scope)
Projektseminar/Seminar/Vorlesun g (Vorlesung oder Seminar)	4	-	Exercises (at least 50%)	-
				•
Frequency of offer:		WiSe and SoSe		
Prerequiste:		Prior participation in HPI-CS-LSA or HPI-CS-SIC is		
Department:		Digital Engineering		

HPI-CS-SSC: Systems Security - Core		Number of credit points (CP): 6			
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module			
Content and qualification goals of the module:	Content: This module addressecure application examined for var Students consider and analyze vulne practical level. Qualification goal The students acquir module. Students: - gain subject-spect - expand their prof - develop discussion - gain experience in analysis methods for - acquire the abili information to solf - can assess the approblems; - can select and a problems; - can present self defend their work; - gain the ability others and check t	esses fundamental me ns and systems. Se ious categories of a various methods of ar erabilities and attack s: ire detailed knowledg eific theoretical and n fessional judgment sk on skills and techniqu n the handling of secu- for vulnerabilities and ity to independently ve problems; applicability of solut apply suitable solutions to critically question heir professional suita	ethods and approach ecurity measures a applications, system halysis that make it p vectors on a theore e of the specialist top hethodological know tills; les; urity measures and c l attack vectors; develop and use s ion concepts and str- to problems and h solutions to proble ability.	nes for developing and concepts are as, and networks. possible to identify etical as well as a pics covered in the vledge; concepts as well as uitable sources of strategies to given ategies to a given have the ability to ems developed by	
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 45 mins.) Written exam, 90- Oral exam, 30-45	pages, together with 120 minutes minutes	a presentation of re	search results (20-	
Self-study time	120				
(in hours [h]):					
Courses (teaching format)	Contact time (in semester	Supplementary ex (number, form, scop	am requirements	Course accompanying module (partial) exam (s)	
	hours)	module	module exam	(number, form, scope)	
Project seminar/seminar/ lecture	4	-	Exercises (at	-	
(lecture or seminar)	I		10050 JU70)		
Frequency of offer:		WiSe and SoSe			
Prerequiste:		None			
Department:	Department:		Digital Engineering		

HPI-CS-SSD: Systems Security - Deep Dive			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: This module addre secure application examined for var Students consider and analyze vulne practical level. Qualification goal: The students acqui module. Students: - gain subject-spect - expand their prof - develop discussion - gain experience in analysis methods f - acquire the abili information to solv - can assess the approblems; - can present self defend their work; - gain the ability others and check t	esses fundamental me ns and systems. Se ious categories of a various methods of an erabilities and attack s: re detailed knowledge effic theoretical and m fessional judgment sk on skills and techniqu n the handling of secu- for vulnerabilities and ity to independently ve problems; applicability of solution developed solutions to critically question heir professional suita	ethods and approach ecurity measures a pplications, system alysis that make it p vectors on a theore e of the specialist top nethodological know ills; es; urity measures and c attack vectors; develop and use su ion concepts and stra to problems and h solutions to proble	hes for developing and concepts are hs, and networks. possible to identify etical as well as a pics covered in the vledge; concepts as well as uitable sources of trategies to given ategies to a given have the ability to ems developed by
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 45 mins.) Written exam, 90- Oral exam, 30-45	pages, together with 120 minutes minutes	a presentation of rea	search results (20-
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements e) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Exercises (at least 50%)	-
Frequency of offer:		WiSe and SoSe		
Prerequiste:		Prior participation in	h HPI-CS-SSC is re	commended.
Department:		Digital Engineering		

HPI-CS-SSS: Systems Security - Specialization			Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: This module addre secure application examined for var Students consider and analyze vulne practical level. Qualification goal The students acqui module. Students: - gain subject-spect - expand their prof - develop discussion - gain experience if analysis methods f - acquire the abili information to solv - can assess the approblems; - can present self defend their work; - gain the ability others and check t	esses fundamental me ns and systems. Se ious categories of a various methods of an erabilities and attack s: re detailed knowledge effic theoretical and m fessional judgment sk on skills and techniqu n the handling of secu- for vulnerabilities and ity to independently ve problems; applicability of solution developed solutions to critically question heir professional suita	ethods and approach ecurity measures a pplications, system alysis that make it p vectors on a theore e of the specialist top hethodological know ills; es; irity measures and c attack vectors; develop and use s ion concepts and stra- to problems and h solutions to proble- ability.	nes for developing and concepts are ns, and networks. possible to identify etical as well as a pics covered in the vledge; concepts as well as uitable sources of strategies to given ategies to a given nave the ability to ems developed by
Partial module exams (number, form, scope):	Exam types: Paper of at least 8 45 mins.) Written exam, 90- Oral exam, 30-45	pages, together with 120 minutes minutes	a presentation of re	search results (20-
Self-study time (in hours [h]):	120			
		a 1		~
	Contact time	Supplementary ex (number, form, scop	am requirements e)	Course accompanying
Courses (teaching format)	(in semester hours)	For completion of module	For admission to module exam	module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture	4	-	Exercises (at	-
	<u> </u>	<u> </u>	10ast 50/0j	l
Frequency of offer:		WiSe and SoSe		
Prerequiste:		Prior participation in HPI-CS-SSC is recommended		
Department:		Digital Engineering		

HPI-CS-STO: Stochastics	Number of credit points (CP): 6			
Module type (compulsory or compulsory elective module):	Compulsory modu	ile/compulsory electiv	ve module	
Content and qualification goals of the module:	Content: This module covers concepts from mathematical probability theory. It includes both discrete probability theory and continuous, especially random, processes. Applications essential to computer science are examined (e.g., hashing, random walks). The focus is on mathematical analysis. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - get to know various classical statements and situations in the field of probability theory, as well as their analyses; - understand problems and pitfalls when dealing with probabilities; - can independently model and analyze situations with uncertainties; - are able to solve problems with uncertainties; - gain insights into the current state of research.			
Partial module exams (number, form, scope):	Exam types: Written exam, 90-120 minutes Oral exam, 30-45 minutes			
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4		Exercises (50%)	-
Frequency of offer: Prerequiste:		SoSe None		
Department:		Digital Engineering		

HPI-DHBMHS: Fundamentals o	f Healthcare Syste	ms	Number of (CP): 6	credit points
Module type (compulsory or compulsory elective module):	Compulsory modu	ile/compulsory electiv	ve module):	
Content and qualification goals of the module:	Content: This module provides the basics of international health systems, as well as the specific requirements and special characteristics required for the area of digital health. Qualification goals: Students acquire a broad background knowledge of health systems. Students: - gain subject-specific theoretical, methodological, and practical knowledge; - learn how to independently work on a topic based on primary and secondary literature; - acquire the ability to independently access and evaluate scientific literature on individual topics; - learn and practice basic academic skills. Exam types:			
Partial module exams (number, form, scope):	Exam types: Written exam, 90-120 minutes Oral exam, 30-45 minutes			
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	-	-
Frequency of offer:		WiSe		
Prerequiste:		None		

HPI-DHBMPM: Introduction to	cine	Number of (CP): 6	credit points	
Module type (compulsory or compulsory elective module):	Compulsory modu	le/compulsory electiv	ve module	
Content and qualification goals of the module:	Content: This module teaches selected foundations and concepts from various areas of medicine and skills for documenting medical issues that are essential in understanding and applying requirements in the area of Digital Health. Qualification goals: Students acquire a broad background knowledge of health systems. Students: - gain subject-specific theoretical, methodological, and practical knowledge; - learn how to independently work on a topic based on primary and secondary literature; - gain the ability to independently access and evaluate scientific literature on individual topics; - learn and practice basic academic skills. Exam types:			
Partial module exams (number, form, scope):	Exam types: Written exam, 90-120 minutes Oral exam, 30-45 minutes			
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Seminar/ lecture (lecture or seminar)	4	-	-	-
Frequency of offer:		WiSe		
Prerequiste:		None		
		Digital Engineering		

HPI-PSK-DS: Design Thinking - Specialization		Number of credit points (CP): 6		
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module		
Content and qualification goals of the module:	Content: This module teach methods of desi innovations, busin process combines and business ad perspective of teat team-based appro- particular—on col developed, discuss specific project of provides in-depth of the integration of made sustainable a Qualification goal. The students acqui module. Students: - gain further subje - can develop and - can present comp - practice advance - practice working in group work; - practice teamwor - practice teamwor - practice conflict - learn advanced a - gain experience i Depending on the English. The teach	hes advanced approa ign thinking—a us ness models, and str methods and tools fi ministration. User chnological feasibilit pach not only relie laboration. In this mo- sed, and practiced to- juestions in advance discourse, methods, ar human-centered design and effective in various ire detailed knowledge ect-specific theoretica try out their creativity poleted tasks and defend d methods and techning on and integrating of methods and techning together in teams rk and collaborative p skills in a team; pproaches to leadersh- in assuming responsib- language of instructi- hing language will be pective course.	iches and principles er-centered concep- rategic futures. The rom the areas of de orientation is con- y and economic s is on individual of odule, central areas gether with project and reflections in ord gn (HCD) and desig us strategic fields of e of the specialist top al and methodologic (7) and their work; ques; delimited contributions s and dealing with problem-solving; hip skills; bility. ion, this module is le	s, techniques, and pt for designing e design thinking ssign, engineering, mbined with the ustainability. The creativity but—in of application are partners based on The module also er to examine how gn thinking can be f action. pics covered in the cal knowledge; ons independently h complex issues
Partial module exams (number, form, scope):	Exam types: Paper, at least 12 p Paper of at least 8 45 mins.) Oral exam, 30-45	pages pages, together with minutes	a presentation of re	search results (20-
Self-study time (in hours [h]):	120			
		Coursela é		Carrie
	Contract	supplementary ex (number, form, score	am requirements	Course accompanying
Courses (teaching format)	(in semester hours)	For completion of module	For admission to module exam	module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Interim presentation (15 minutes)	-
Prequency of offer:		Wise and SoSe		
Department:		None Digital Engineering		

HPI-PSK-DT: Design Thinking	Number of credit points (CP): 6				
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module			
Content and qualification goals of the module:	This module teaches advanced approaches and principles, techniques, and methods of design thinking—a user-centered concept for designing innovations, business models, and strategic futures. The design thinking process combines methods and tools from the areas of design, engineering, and business administration. User orientation is combined with the perspective of technological feasibility and economic sustainability. The team-based approach not only relies on individual creativity but—in particular—on collaboration. In this module, central areas of application are developed, discussed, and practiced together with project partners based on specific project questions in advanced design studios. The module also provides in-depth discourse, methods, and reflections in order to examine how the integration of human-centered design (HCD) and design thinking can be made sustainable and effective in various strategic fields of action. Students: gain further subject-specific theoretical and methodological knowledge; can develop and try out their creativity; can present completed tasks and defend their work; practice advanced methods and techniques; practice working on and integrating delimited contributions independently in group work; practice teamwork and collaborative problem-solving; practice teamwork and collaborative problem-solving; practice conflict skills in a team; learn advanced approaches to leadership skills; gain experience in assuming responsibility. Depending on the language of instruction, this module is held in German or English. The teaching language will be announced in sufficient time before				
Partial module exams (number, form, scope):	Exam types: Paper of at least 12 pages Paper of at least 8 pages, together with a presentation of research results (20- 45 mins.)			search results (20-	
Self-study time (in hours [h]):	120				
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)	
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Interim presentation (15 minutes)	-	
E		W'0 10 0			
Frequency of offer: WiSe		WiSe and SoSe	WiSe and SoSe		
Department:		Digital Engineering			
Department:		Digital Engineering			

HPI-PSK-EI: Entrepreneurship und Innovation		Number of credit points (CP): 6		
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module	, , , , , , , , , , , , , , , , , , ,	
	Content: This module provides fundamental, practical and theoretical knowledge in the areas of entrepreneurship, technology, and innovation management. Students learn and practice entrepreneurial thought and action. They learn to solve problems, generate ideas and, from them, business models. Students learn about the challenges of starting a business and receive the motivation to found a startup themselves. The module also covers instruments from the field of empirical social research: business modeling, design thinking, lean start- up, and strategic technology foresight. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module			
Content and qualification goals of the module:	 Students: gain subject-specific theoretical and methodological knowledge; learn a science-oriented way of thinking and proceeding; work on specific problems in a team; can develop and try out their creativity; can present completed tasks and defend their work; learn to work on specific contributions independently in group work; practice teamwork and problem-solving; practice conflict skills in a team; learn approaches to leadership skills; gain experience in assuming responsibility. Depending on the language of instruction, this module is held in German or English. The teaching language will be announced in sufficient time before the start of the respective course. 			
Partial module exams (number, form, scope):	Exam types: Paper, (at least 12 pages) Paper, (at least 8 pages) together with a presentation of research results (20- 45 mins.) Written exam, (90-120 minutes)			
Self-study time	120			
Courses (teaching format))	Contact time	Supplementary exam requirements (number, form, scope)		Course accompanying
	(in semester hours)	For completion of module	For admission to module exam	module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Interim presentation (15 minutes)	-
Frequency of offer:		WiSe and SoSe		
Prerequisie:		None Digital Engineering		
Department:		Digital Engineering		

HPI-PSK-ES: Entrepreneurship		Number of (CP): 6	credit points	
Module type (compulsory or compulsory elective module):	Compulsory elective module			
Content and qualification goals of the module:	Content This module provides fundamental, practical and theoretical knowledge in the areas of entrepreneurship, technology, and innovation management. Students learn and practice entrepreneurial thought and action. They learn to generate creative ideas, transform them into successful business models and communicate them successfully to an audience. The module takes a deep dive into both the challenges as well as the opportunities of founding a company, including new types of companies. Students will be motivated to found a startup themselves. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - gain subject-specific theoretical and methodological knowledge; - learn a science-oriented way of thinking and proceeding; - work on specific problems in a team; - can develop and try out their creativity; - can present completed tasks and defend their work; - practice teamwork and problem-solving; - practice conflict skills in a team; - learn a proaches to leadership skills; - gain experience in assuming responsibility. Depending on the language of instruction, this module is held in German or English. The teaching language will be announced in sufficient time before the start of the respective course.			
Partial module exams (number, form, scope):	Exam types: Paper, (at least 8 pages) together with a presentation of research results (20- 45 minutes) Written exam, (90-120 minutes) Oral exam. (30-45 minutes)			
Self-study time (in hours [h]):	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to module exam	Course accompanying module (partial) exam (s) (number, form, scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Interim presentation (15 minutes)	-
Frequency of offer		WiSe and SoSe		
Prerequiste:		None		
Department:		Digital Engineering		

HPI-PSK-LC: Law and Complia	Number of credit points (CP): 6			
Module type (compulsory or compulsory elective module):	Compulsory elective module			
Content and qualification goals of the module:	Content: This module provides an overview of legal issues as well as compliance principles and standards in the IT industry. This includes legal issues when creating and using software systems—such as the handling of personal data, liability, copyright, and licensing. These are viewed within a national and international framework. The learning goal is to recognize legal dangers and prevent them from occurring and to act in a legally secure and compliant manner. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - gain subject-specific theoretical, methodological and practical knowledge; - can select and apply suitable solution concepts and strategies to legal questions; - expand their professional judgment skills; - can address risks through the collection and use of data in a qualified manner; - gain experience in the formalization and abstraction of problems; - are able to independently access and evaluate scientific literature on individual topics; Depending on the language of instruction, this module is held in German or English. The teaching language will be announced in sufficient time before the start of the respective course.			
Partial module exams (number, form, scope):	Exam types: Paper, (at least 12 pages) Paper, (at least 8 pages) together with a presentation of research results (20- 45 minutes) Written exam. (90-120 minutes)			
Self-study time	120			
Courses (teaching format)	Contact time (in semester hours)	Supplementary ex (number, form, scop For completion of module	am requirements be) For admission to	Course accompanying module (partial) exam (s) (number form
		module		scope)
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Interim presentation (15 minutes)	-
Frequency of offer:		WiSe and SoSe		
Prerequiste:		None		
Department:		Digital Engineering		

HPI-PSK-ML: Management und Leaders	Number of credit points (CP): 6				
Content and qualification goals of the module:	Compulsory elective module				
Content and qualification goals of the module:	Content: This module teaches management skills that are necessary for planning and managing complex IT or big data projects, as well as general skills in the area of management and strategic business management. The offerings include those in areas of methodological skills, action skills, social skills, and personal skills. Qualification goals The students acquire detailed knowledge of the specialist topics covered in the module. Students: - gain subject-specific theoretical and methodological knowledge; -gain knowledge of topics such as continuous strategic and organizational change and change management; - gain experience in assuming responsibility; - gain experience in self-organization; - acquire planning skills; - gain gender and diversity competence; - learn how to manage and work in teams as well as how to deal with problems and complex tasks that occur in collaborative work; - practice conflict skills in a team; - learn approaches to leadership and management skills; - train endurance. Depending on the language of instruction, this module is held in				
Partial module exams (number, form, scope):	German or English. The teaching language will be announced in sufficient time before the start of the respective course. Exam types: Paper, (at least 8 pages) together with a presentation of research results (20-45 minutes) Written exam, 90-120 minutes Outlement, 20, 45 minutes				
Self-study time (in hours [h]):	120				
	Contact Supplementary exam requirements (number, form, scope)		Course accompanying		
Courses (teaching format)	(in semeste r hours)	For completion of module	For admission to module exam	module (partial exam (s) (number, form scope)	
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Interim presentation (15 minutes)	-	
		1			
Frequency of offer:		WiSe and SoSe			
Prerequiste:		None			
Department:		Digital Engineering			

HPI-PSK-TC: Technology Comn	ansfer	Number of (CP): 6	credit points		
Module type (compulsory or compulsory elective module):	Compulsory electi	ve module			
Content and qualification goals of the module:	Content: This module teaches different types of oral and written communication skills that play a role in various professional contexts of digital engineering in science and business. The focus is always on communicating specialist knowledge verbally and in writing to different target groups. The module covers aspects of the preparation and implementation of (scientific) presentations and lectures. Students learn pitch and presentation techniques, and techniques in communication management and writing. Students also learn how written communication differs from communication in a "live" situation, and how to optimally convey content in different media. Qualification goals: The students acquire detailed knowledge of the specialist topics covered in the module. Students: - gain subject-specific theoretical and methodological knowledge; - can select and apply suitable solution concepts and strategies to a given problem; - practice communication skills; - learn presentation techniques in physical and digital contexts; - practice communication skills; - learn presentation techniques in physical and digital contexts; - practice conflict management skills in a team. Depending on the language of instruction, this module is held in German or English. The teaching language will be announced in sufficient time before the start of the respective course.				
Partial module exams (number, form, scope):	Exam types: Paper, (at least 8 pages) together with a presentation of research results (20- 45 minutes) Written exam, 90-120 minutes Oral exam, 30-45 minutes				
Self-study time	120				
Courses (teaching format)	Contact time (in semester hours)	Supplementaryexamrequirements(number, form, scope)For completion ofFor admission tomodulamodulamodula		Course accompanying module (partial) exam (s) (number, form,	
Project seminar/seminar/ lecture (lecture or seminar)	4	-	Interim presentation (15 minutes)	scope) -	
		1			
Frequency of offer:		WiSe and SoSe			
Prerequiste:		None			
Department:		Digital Engineering			