FRANKFURT UNIVERSITY OF APPLIED SCIENCES

Prüfungsordnung

des konsekutiven Master-Studiengangs

High Integrity Systems

(M.Sc.)

Fb 2: Informatik und Ingenieurwissenschaften

Wissen durch Praxis stärkt

Prüfungsordnung des Fachbereichs 2: Informatik und Ingenieurwissenschaften – Computer Science and Engineering der Frankfurt University of Applied Sciences für den Master-Studiengang High Integrity Systems vom 29. Mai 2019

Aufgrund des § 44 Abs. 1 Nr. 1 des Hessischen Hochschulgesetzes (HHG) vom 14. Dezember 2009 (GVBl. S. 666), zuletzt geändert durch Gesetz vom 18. Dezember 2017 (GVBl. S. 482), hat der Fachbereichsrat des Fachbereichs 2: Informatik und Ingenieurwissenschaften – Computer Science and Engineering der Frankfurt University of Applied Sciences am 29. Mai 2019 die nachstehende Prüfungsordnung für den Master-Studiengang High Integrity Systems beschlossen. Die Prüfungsordnung entspricht den Allgemeinen Bestimmungen für Prüfungsordnungen mit den Abschlüssen Bachelor und Master an der Frankfurt University of Applied Sciences (AB Bachelor/Master) vom 10. November 2004 (Staatsanzeiger für das Land Hessen 2005 S. 519), zuletzt geändert am 20. Februar 2019 (veröffentlicht am 13. März 2019 auf der Internetseite in den Amtlichen Mitteilungen der Frankfurt University of Applied Sciences) und ergänzt sie.

Die Prüfungsordnung wurde durch das Präsidium am 19.08.2019 gemäß § 37 Abs. 5 HHG genehmigt.

Inhaltsübersicht

Anlagen

§ 1 Akademischer Grad

Aufgrund der bestandenen Master-Prüfung verleiht die Frankfurt University of Applied Sciences den akademischen Grad Master of Science (M. Sc.).

§ 2 Qualifikationsziele

Die Beschreibung der Qualifikationsziele folgt dem Qualifikationsrahmen für Deutsche Hochschulabschlüsse für das Master-Niveau und enthält die Rubriken Wissensverbreiterung, Wissensvertiefung, Wissensverständnis, Nutzung und Transfer, Wissenschaftliche Innovation, Kommunikation und Kooperation sowie Wissenschaftliches Selbstverständnis.

Wissensverbreiterung

Die Absolventinnen und Absolventen verfügen über fortgeschrittenes Wissen der Informatik im Zusammenhang mit der Entwicklung und Erforschung kritischer Systeme und sind in der Lage, sich an den aktuellen wissenschaftlichen und technischen Entwicklungen des Gebiets zu beteiligen.

Wissensvertiefung

Die Absolventinnen und Absolventen beherrschen Techniken des wissenschaftlichen Schreibens und des wissenschaftlichen Vortrags, Instrumente des Selbst- und Projektmanagements in allen Phasen der Entwicklung softwaregestützter, kritischer Systeme, sowie der wissenschaftlichen Informationsbeschaffung und -verarbeitung, einschließlich aller relevanten Softwaretools. Sie haben gelernt, Anforderungen, Probleme und Ergebnisse ihrer Arbeit in englischer Sprache zu formulieren. Sie beherrschen je nach den gewählten Wahlmodulen die wesentlichen Methoden der Anforderungsanalyse, des Entwurfs, der Implementierung, des Tests und der Qualitätssicherung, und der Zertifizierung von sicherheitskritischen, missionskritischen und geschäftskritischen computergestützten Systemen. Die erworbenen Methoden qualifizieren die Absolventinnen und Absolventen für die angestrebten beruflichen Tätigkeitsfelder (Forschung & Entwicklung, Qualitätssicherung, Beratung, Projektleitung, Management). Sie kennen die Grundlagen angrenzender Fachgebiete und beziehen diese Kenntnisse in ihre Tätigkeit ein. Sie sind sich der ethischen und gesellschaftlichen Wirkungen ihrer Tätigkeit bewusst.

Wissensverständnis

Bei der Lösung konkreter Forschungs- und Entwicklungsaufgaben wenden sie ihr Wissen an, erkennen die Grenzen von Technologien und Wissenschaft und sind in der Lage, diese anforderungsgerecht zu beurteilen und zu bewerten. Dabei wenden sie das Fachwissen und Erfahrungen an, die sie in ihrem Studium je nach gewählten Wahlmodulen in theoretischen und praxisorientierten Modulen erworben haben.

Nutzung und Transfer

Die Absolventinnen und Absolventen sind in der Lage, sich relevante Informationen zu beschaffen, diese zu verarbeiten und darauf basierende, fundierte Entscheidungen zu treffen. Sie kennen die relevanten Organisations- und Teamstrukturen und –dynamiken und sind in der Lage, im Rahmen eines Teams eine gemeinsame Aufgabenstellung erfolgreich zu bearbeiten.

Wissenschaftliche Innovation

Die Absolventinnen und Absolventen können die Anforderungen an eine technisch/ wissenschaftliche Aufgabenstellung beurteilen, Lösungsansätze erforschen und entwickeln und selbstständig umsetzen. Sie können daraus offene Fragestellungen ableiten und hierfür neue Lösungsansätze auf Basis des aktuellen Standes der Forschung entwickeln. Im Rahmen von Projektarbeiten und der Masterthesis haben sie gelernt, ihre Ergebnisse wissenschaftlich zu dokumentieren, zu präsentieren und vor einem Fachpublikum begründet zu rechtfertigen.

Kommunikation und Kooperation

Die Absolventinnen und Absolventen sind in der Lage, sich in fremde Fach- und Wissenschaftsgebiete einzuarbeiten und zusammen mit Fachleuten fremder Fachgebiete Lösungen für interdisziplinäre Problemstellungen zu finden. Die Absolventinnen und Absolventen verfügen damit sowohl über die interpersonelle Kompetenz des Arbeitens im Team mit Fachleuten der eigenen Disziplin, als auch der interdisziplinären Teamarbeit. Im Laufe verschiedener Arbeitssituationen während ihres Studiums haben sie kooperatives Lern- und Arbeitsverhalten erworben.

Wissenschaftliches Selbstverständnis/ Professionalität

Die Absolventinnen und Absolventen erkennen die Anforderungen von Unternehmen, staatlichen Organisationen und der Gesellschaft an die Entwicklung kritischer Systeme. Sie sind darauf vorbereitet, Projekt- oder Führungsverantwortung zu übernehmen. Sie entwickeln ihre Sensibilität für die Denkweisen fachfremder Disziplinen und lernen, technische und wissenschaftliche Zusammenhänge im Rahmen unterschiedlicher wissenschaftlicher Disziplinen verständlich zu machen.

Durch den Einblick, den sie in ihrer Fachdisziplin und interdisziplinär erworben haben, sind sie insbesondere darauf vorbereitet, tiefer gehende fachliche Expertise anzufordern und in ihre Aufgaben einzubinden. Sie besitzen damit die entsprechenden Kompetenzen, die sie für die selbständige Arbeit in der Informatik qualifizieren.

Die Absolventinnen und Absolventen erkennen und reflektieren an sie gestellte fachliche Anforderungen ebenso, wie ihre berufliche Verantwortung für Menschen, Gesellschaft und Ökologie.

§ 3 Zulassungsvoraussetzungen

(1) Zum Master-Studiengang High Integrity Systems kann nur zugelassen werden, wer
1. die Bachelor- oder Diplomprüfung
   a. in einem mindestens sechssemestrigen Hochschulstudiengang mit mindestens 180 ECTS-Punkten (Credit Points) in der Fachrichtung Informatik oder
   b. in einem anderen Studiengang, dessen Informatikanteil mindestens 60 % der in diesem Studiengang möglichen ECTS-Punkte (Credit Points) beträgt,

   erworben hat.

   Die Note des Hochschulabschlusses muss mindestens 2,0 betragen.
2. über sehr gute Kenntnisse der englischen Sprache verfügt, die nachgewiesen werden durch
   a. Test of English as a Foreign Language (TOEFL) mit einem Minimalergebnis von 79 (iTB) oder
   b. International English Language Testing mit einem Minimalergebnis von 6 oder
   c. Cambridge Certificate mit einem Minimalergebnis First Certificate in English (FCE, ehemals: A) oder
   d. andere Sprachnachweise, die eine Sprachkompetenz von mindestens B2 des vom Europarat empfohlenen Gemeinsamen Europäischen Referenzrahmens (GER) ausweisen und nicht älter als zwei Jahre sind.

   Auf den Nachweis von sehr guten Kenntnissen der englischen Sprache wird verzichtet, wenn
   a. Englisch die Muttersprache der Bewerberin oder des Bewerbers ist oder
   b. der unter Absatz 1 Ziffer 1 erworbene berufsqualifizierende Hochschulabschluss im englischen Sprachraum erworben wurde oder
   c. der unter Absatz 1 Ziffer 1 erworbene berufsqualifizierende Hochschulabschluss einen Anteil von mindestens 30 ECTS-Punkten an englischsprachigen Modulen aufweist.

(2) Für Bewerberinnen und Bewerber mit ausländischen Vorbildungsnachweisen gilt ergänzend zu Absatz 1 die Satzung über das Verfahren zur Bewertung und Zulassung von Studienbewerberinnen und Studienbewerbern mit ausländischen Vorbildungsnachweisen an der Fachhochschule Frankfurt am Main in der jeweils gültigen Fassung.

(3) Es sind von allen Bewerberinnen und Bewerbern die folgenden Unterlagen zur Bewerbung beizufügen:
1. Nachweise über die nach Absatz 1 genannten Zulassungsvoraussetzungen,
2. ein Curriculum Vitae, das die Studien- und Arbeitserfahrungen bis zum Datum der Bewerbung darstellt,
3. ein Motivationsschreiben, in dem dargelegt wird, worin das besondere Interesse am Master-Studium High Integrity Systems besteht und wo die eigene Qualifikation für diesen Studiengang gesehen wird,

Auf der Grundlage dieser Unterlagen erfolgt die Auswahl der Bewerberinnen und Bewerber durch den Prüfungsausschuss. Bewerberinnen und Bewerber, welche die erforderliche Eignung nach Absatz 1 nachweisen und die nach Absatz 3 erforderlichen Bewerbungsunterlagen eingereicht haben, werden zugelassen.

(4) Für die Bewerbung einschließlich aller aussagekräftigen Unterlagen gelten die auf der Homepage der Hochschule veröffentlichten Bewerbungsfristen für den Master-Studiengang High Integrity Systems.

(5) Nach Maßgabe freier Studienplätze können auf Vorschlag des Prüfungsausschusses weitere Bewerberinnen und Bewerber mit einer Gesamtnote zwischen 2,0 und 3,0 zugelassen werden.
(6) Für Bewerberinnen und Bewerber mit einer Durchschnittsnote zwischen 2,0 und 3,0 kann der Prüfungsausschuss die Zulassung erteilen, wenn sie ihre besondere Qualifikation durch eine erfolgreiche und auf das Curriculum des Studiengangs bezogene Berufstätigkeit oder durch besonders interessante Informatikprojekte nach dem ersten Studienabschluss nachweisen. Der Nachweis der besonderen Qualifikation kann über Arbeitsberichte, Fachaufsätze, Tagungsbeiträge und ähnliches erfolgen. Zur Überprüfung der Eignung sind Zeugnisse und Leistungsbeurteilungen einzureichen, die das Vorliegen der Voraussetzungen nach Absatz 1 erkennen lassen.

§ 4 Regelstudienzeit, Anzahl der ECTS-Punkte (Credit Points) und Module

(1) Die Regelstudienzeit dieses Studienprogramms beträgt vier Semester.
(2) Das Studienprogramm ist ein modular aufgebautes Vollzeitstudium und ist auf der Basis von Leistungspunkten gemäß dem „European Credit Transfer System (ECTS)“ organisiert.
(3) Das Studienprogramm umfasst 120 ECTS-Punkte (Credit Points [CP]). Ein ECTS-Punkt (Credit Point) entspricht einem studentischen Arbeitsaufwand (Workload) von 30 Stunden.
(4) Das Studienprogramm umfasst 18 Module, davon sind zehn Module Pflichtmodule und acht Module sind Wahlpflichtmodule.
(5) Die Wahlpflichtmodule werden aus den folgenden Wahlpflichtbereichen ausgewählt:
- Compulsory Elective Subjects I (Module 4.1 und 4.2),
- Compulsory Elective Subjects II Module (6.1 und 6.2),
- Compulsory Elective Subjects III (Module 8.1 und 8.2),
- Compulsory Elective Subjects IV (Module 10.1 und 10.2),
- Compulsory Elective Subjects V (Module 12.1, 12.2 und 12.3),
- Compulsory Elective Subjects VI (Module 13.1, 13.2 und 13.3),
- Compulsory Elective Subjects VII (Module 14.1, 14.2 und 14.3) und
- Compulsory Elective Subjects VIII (Module 16.1, 16.2 und 16.3).

Dabei ist aus jedem der acht Wahlpflichtbereiche ein Modul auszuwählen.
(6) Der Fachbereichsrat beschließt jedes Semester die Module des nächsten Semesters und veröffentlicht eine Liste der angebotenen Module spätestens vier Wochen vor Semesterbeginn.
(7) Nach Ablauf des Rücknahmezeitraumes für die Anmeldung zur Modulprüfung ist die Wahl eines Wahlpflichtmoduls verbindlich. Ein Wechsel ist danach nicht mehr möglich.
(8) Die Inhalte der Module, die Anzahl der jeweiligen ECTS-Punkte (Credit Points), die Voraus setzungen für die Zulassung zu einer Modulprüfung und die Art und Dauer der jeweiligen Modulprüfungsleistungen ergeben sich aus den Modulbeschreibungen (Anlage 3).
(9) Die Module werden in englischer Sprache durchgeführt.

§ 5 Prüfungsleistungen

(1) Die Art der Modulprüfungsleistung oder Modulteilprüfungsleistung im Sinne von § 7 Abs. 3 in Verbindung mit § 10 Abs. 1 AB Bachelor/Master wird in der jeweiligen Modulbeschreibung (Anlage 3) geregelt.

(2) Die Modulprüfungen in den Modulen werden in englischer Sprache durchgeführt.

§ 6 Wiederholbarkeit von Prüfungsleistungen

(1) Eine Modulprüfung ist bestanden, wenn die Modulprüfungsleistung oder alle dem Modul zugeordneten Modulteilprüfungsleistungen mit mindestens „ausreichend“ (4,0) bewertet wurden.

(2) Nicht bestandene Modulprüfungsleistungen oder Modulteilprüfungsleistungen können zweimal wiederholt werden. Die Prüfungsleistung des Moduls Master-Arbeit mit Kolloquium kann nur einmal wiederholt werden.

(3) Bestandene Modulprüfungsleistungen oder Modulteilprüfungsleistungen können nicht wiederholt werden.

§ 7 Master-Arbeit mit Kolloquium

(1) Der Bearbeitungsumfang für das Modul Master-Arbeit mit Kolloquium beträgt 30 ECTS-Punkte (Credit Points).

(2) Bei der Meldung zur Master-Arbeit sind vorzulegen:

a. der Nachweis, dass die Module der ersten drei Semester gemäß Anlage 2 Modulübersicht und Anlage 3 Modulbeschreibungen erfolgreich abgeschlossen sind,

b. die schriftliche Einverständniserklärung der Referentin oder des Referenten, dass sie oder er die Betreuung der Abschlussarbeit übernimmt.

(3) Die Anmeldung zur Master-Arbeit ist schriftlich an den Prüfungsausschuss zu richten. Aufgrund der eingereichten Unterlagen entscheidet der Prüfungsausschuss über die Zulassung zur Master-Arbeit und legt die Prüferinnen oder die Prüfer fest.

(4) Die Zeit von der Ausgabe der Master-Arbeit bis zur Abgabe der Master-Arbeit beträgt 20 Wochen. Die Ausgabe des Themas für die Master-Arbeit erfolgt mit dem Tag der Zulassung der Studierenden oder des Studierenden zur Master-Arbeit durch den Prüfungsausschuss.

(5) Die Master-Arbeit ist in schriftlicher Form fristgerecht beim Prüfungsamt des Fachbereichs 2 in zwei gebundenen Ausfertigungen einzureichen. Den Ausfertigungen ist jeweils eine elektronische Form auf einem gängigen Datenträger (z.B. CD/DVD, USB, Flash) beizufügen. Teile der Master-Arbeit, die als Quellprogrammdateien oder ausführbare Dateien oder sonstige Dateien vorliegen, sind auf einem zeitgemäßen Medium beizufügen. Das Abgabedatum wird aktenkundig gemacht.

(6) Kann der Abgabetermin aus Gründen, die die Studierende oder der Studierende nicht zu vertreten hat, nicht eingehalten werden, so wird auf Antrag der oder des Studierenden die Bearbeitungszeit nach Maßgabe des § 26 AB Bachelor/Master um die Zeit der Verhinderung, längstens jedoch um sechs Wochen verlängert. Dauert die Verhinderung länger, so kann die Studierende oder der Studierende von der Prüfungsleistung zurücktreten.

(7) Die Master-Arbeit ist in englischer Sprache abzufassen.

(8) Die Master-Arbeit wird von zwei Prüferinnen oder Prüfern bewertet. Bei unterschiedlicher Bewertung der Master-Arbeit wird von der Vorsitzenden oder dem Vorsitzenden des Prüfungsausschusses die Note aus dem arithmetischen Mittel der Einzelnoten gebildet. Der Prüfungsausschuss holt die Stellungnahme einer dritten Prüferin oder eines dritten Prüfers ein, wenn die Beurteilungen der Prüfenden um mehr als 2,0 voneinander abweichen oder wenn nur eine oder einer der Prüfenden die Master-Arbeit als "nicht ausreichend" beurteilt. Die Note wird in diesem Fall aus den Noten der Erstprüferin oder des Erstprüfers, der Zweitprüferin oder des Zweitprüfers und der Drittprüferin oder des Drittprüfers aus dem arithmetischem Mittel der Einzelnoten gebildet.

(9) Die Master-Arbeit ist Gegenstand eines Abschluss-Kolloquiums. Die Dauer des Kolloquiums beträgt mindestens 30 Minuten, höchstens 60 Minuten. Das Kolloquium setzt das Bestehen der Master-Arbeit voraus und findet vor zwei Prüferinnen oder Prüfern statt. Das Kolloquium soll spätestens sechs Wochen nach Abgabe der Master-Arbeit stattfinden. Das Ergebnis des Kolloquiums geht mit einem Gewicht von 30 % in die Bewertung des Moduls Master-Arbeit mit Kolloquium ein.

§ 8 Bildung der Gesamtnote

Die Gesamtnote der Master-Prüfung wird gebildet aus der Summe der Produkte der Noten der einzelnen Module mit ihren Gewichtungsfaktoren gemäß der Modulübersicht (Anlage 2), dividiert durch die Summe der Gewichte. Das Gewicht, mit dem die Note in die Gesamtnote eingeht, ergibt sich aus Anlage 2 Modulübersicht.

§ 9 Zeugnis, Urkunde und Diploma Supplement

(1) Nach bestandener Master-Prüfung erhält die Studierende oder der Studierende ein Zeugnis, die Master-Urkunde und ein Diploma Supplement (Anlage 4) nach Maßgabe des § 22 AB Bachelor/Master.

(2) In das Zeugnis über die Master-Prüfung sind ergänzend zu den Angaben nach § 22 AB Bachelor/Master auf Antrag der oder des Studierenden das Ergebnis der Prüfungen in den Zusatzmodulen aufzunehmen.

§ 10 Inkrafttreten und Übergangsregelungen

(1) Die Prüfungsordnung tritt am 1. Oktober 2019 zum Wintersemester 2019/20 in Kraft und wird auf einem zentralen Verzeichnis auf der Internetseite der Frankfurt University of Applied Sciences (in den amtlichen Mitteilungen) veröffentlicht.

(2) Die Prüfungsordnung vom 13. Dezember 2006, zuletzt geändert am 12. Juli 2017, wird aufgehoben. Abs. 3 bleibt unberührt.

(3) Studierende, die vor Inkrafttreten dieser Prüfungsordnung ihr Studium begonnen haben, können noch bis spätestens mit Ablauf des Sommersemesters 2022 ihr Studium nach der Prüfungsordnung vom 13. Dezember 2006, zuletzt geändert am 12. Juli 2017, abschließen, danach setzen sie ihr Studium gemäß dieser Prüfungsordnung fort.

(4) Beim Wechsel in die Prüfungsordnung vom 29. Mai 2019 werden Leistungen, die nach der Prüfungsordnung vom 13. Dezember 2006, zuletzt geändert am 12. Juli 2017, erbracht wurden, durch den Prüfungsausschuss anerkannt.

Frankfurt am Main, den _____

Prof. Achim Morkramer
Dekan des Fachbereichs 2:
Informatik und Ingenieurwissenschaften -Computer Science and Engineering
Frankfurt University of Applied Sciences

Anlage 1:
Modulübersicht Studienbeginn Wintersemester

High Integrity Systems (M.Sc.) **Module overview (start of studies in winter semester)**							Credit points (CP): 120	
Semester 4 Summer Semester	Master thesis with colloquium 30 CP						30	
Semester 3 Winter Semester	Com-pulsory Elective Subjects VI 5 CP	Com-pulsory Elective Subjects VII 5 CP	Com-pulsory Elective Subjects VIII 5 CP	Formal Specifica-tion and Verifica tion 5 CP	HIS project 10 CP		30	
Semester 2 Summer Semester	Mathe-matics Update 5 CP	Com-pulsory Elective Subjects III 5 CP	Com-pulsory Elective Subjects IV 5 CP	Com-pulsory Elective Subjects V 5 CP	Advanced IT-Security CP	Data Mining Methods 5 CP	30	
Semester 1 Winter Semester	Safety Critical Computer Systems 5 CP	Advanced Formal Modeling 5 CP	Intro-ductory Data Analysis 5 CP	Implemen tation of DBMS 5 CP	Com-pulsory Elective Subjects I 5 CP	Com-pulsory Elective Subjects II 5 CP	30	

Modulübersicht Studienbeginn Sommersemester

High Integrity Systems (M.Sc.) **Module overview (start of studies in summer semester)**							Credit points (CP): 120	
Semester 4 Winter semester	Master thesis with colloquium 30 CP						30	
Semester 3 Summer Semester	Com-pulsory Elective Subjects VI 5 CP	Com-pulsory Elective Subjects VII 5 CP	Com-pulsory Elective Subjects VIII 5 CP	Formal Specifica-tion and Verifica-tion 5 CP	HIS project 10 CP		30	
Semester 2 Winter Semester	Mathe-matics Update 5 CP	Advanced Formal Modeling 5 CP	Intro-ductory Data Analysis 5 CP	Implemen tation of DBMS 5 CP	Com-pulsory Elective Subjects I 5 CP	Com-pulsory Elective Subjects II 5 CP	30	
Semester 1 Summer Semester	Safety Critical Computer Systems 5 CP	Com-pulsory Elective Subjects III 5 CP	Com pulsory Elective Subjects IV 5 CP	Com pulsory Elective Subjects V 5 CP	Advanced IT-Security CP	Data Mining Methods 5 CP	30	

ECTS-/Workload-Übersicht High Integrity Systems (M.Sc.)

- Anlage 2 zur Prüfungsordnung –

(Module – ECTS – Dauer – Prüfungsform – Sprache d. Moduls)

No.	Module Title	ECTS CP	Duration [Sem.]	Assessment type	Language	weighting
1st Semester						
1	Safety Critical Computer Systems (for students starting in the winter semester)	5	1	Oral examination (min. 15, max. 45 minutes)	English	1/24
7	Mathematics Update (for students starting in the summer semester)	5	1	Written examination (90 minutes)	English	1/24
2	Advanced Formal Modeling	5	1	Written computer based examination (90 minutes) ER*	English	1/24
3	Introductory Data Analysis	5	1	Written computer-based examination (90 minutes) ER*	English	1/24
4	Compulsory Elective Subjects I					
4.1.	Advanced Real-Time Systems	5	1	Project (submission period 8 weeks) with presentation (min. 10, max. 20 minutes)	English	1/24
4.2.	Machine Learning	5	1	Written examination (90 minutes)	English	1/24
5	Implementation of Database Management Systems (DBMS)	5	1	Written examination (90 minutes)	English	1/24
6	Compulsory Elective Subjects II					
6.1	Pattern Oriented Software Architecture	5	1	Oral examination (min. 15, max. 45 minutes)	English	1/24
6.2	Quantum Information Science	5	1	Oral examination (min. 15, max. 45 minutes)	English	1/24
2nd Semester						
1	Safety Critical Computer Systems (for students starting in the summer semester)	5	1	Oral examination (min. 15, max. 45 minutes)	English	1/24
7	Mathematics Update (for students starting in the winter semester)	5	1	Written examination (90 minutes)	English	1/24

No.	Module Title	ECTS CP	Duration [Sem.]	Assessment type	Language	weighting
8	Compulsory Elective Subjects III					
8.1	Advanced Distributed Systems	5	1	Written examination (90 minutes)	English	1/24
8.2	Advanced Testing Methods	5	1	Written examination (90 minutes)	English	1/24
9	Advanced IT-Security	5	1	Written examination (120 minutes)	English	1/24
10	Compulsory Elective Subjects IV					
10.1	Human Machine Interaction	5	1	Project (submission period 8 weeks) with presentation (min. 10, max. 20 minutes)	English	1/24
10.2	Smart Sensor Network Systems	5	1	Project (submission period 8 weeks) with presentation (min. 10, max. 20 minutes)	English	1/24
11	Data Mining Methods	5	1	Written computer-based examination (90 minutes) ER*	English	1/24
12	Compulsory Elective Subjects V					
12.1	System Theory and Modeling	5	1	Written examination (90 minutes)	English	1/24
12.2	Transaction Management	5	1	Written examination (90 minutes)	English	1/24
12.3	Learning from Data	5	1	Written project report (submission period 6 weeks) with presentation (min. 15, max. 45 minutes)	English	1/24
	3rd Semester					
13	Compulsory Elective Subjects VI					
13.1	Multivariate Data Analysis	5	1	Written computer-based examination (90 minutes) ER*	English	1/24
13.2	Simulation Methods	5	1	Written examination (90 minutes) ER*	English	1/24

No.	Module Title	ECTS CP	Duration [Sem.]	Assessment type	Language	weighting
13.3	Artificial Intelligence	5	1	Written examination (90 minutes)	English	1/24
14	Compulsory Elective Subjects VII					
14.1	Standards and Certification	5	1	Project (submission period 8 weeks) with presentation (min. 20, max. 30 minutes)	English	1/24
14.2	Current Topics in High Integrity Systems	5	1	Project (submission period 8 weeks) with presentation (min. 20, max. 30 minutes)	English	1/24
14.3	Internet of Things	5	1	Project (submission period 8 weeks) with presentation (min. 20, max. 30 minutes)	English	1/24
15	Formal Specification and Verification	5	1	Written computer-based examination (90 minutes)	English	1/24
16	Compulsory Elective Subjects VIII					
16.1	Selected Subjects in Current Web Engineering	5	1	Written examination (90 minutes)	English	1/24
16.2	Mobile Systems and Applications	5	1	Written examination (90 minutes)	English	1/24
16.3	Cloud Computing	5	1	Written examination (90 minutes)	English	1/24
17	High Integrity Systems Project	10	1	Project (submission period 8 weeks) with presentation (min. 20, max. 30 minutes)	English	1/12
	4th semester					
18	Master Thesis with Colloquium	30	1	Master-Thesis (processing time: 20 weeks) with Colloquium (min. 30, max. 60 minutes)	English	1/4

*ER = Module examination requirements

Anlage 3: Modulbeschreibungen

Module 1

Module title	Safety Critical Computer Systems
Module number	1
Study program	High Integrity Systems (M.Sc.)
Module usability	Barrierefreie Systeme (M.Sc.)
Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory module
ECTS (CP) / Workload (h)	5 CP/ 150 h
Module prerequisites	None
Module examination requirements	None
Module examination	Oral examination (min. 15, max. 45 minutes)
Learning outcomes and skills	Upon completion of this course, the student is able to: • distinguish between reliability and safety, • critically read accident reports, • perform a hazard analysis for a computer-based system, • write requirements for a safety-critical system and trace safety constraints to design, • work with human factors experts in the design of safe human-computer interaction, • apply the principles of safe design to both systems and software, • criticize and evaluate a system design for safety, and design a process for building a safety-critical system, • distinguish between the role of practitioners and managers. • respect cultural and social aspects of project work in international R&D teams • present • apply team leading skills • practice scientific literature research and handling • apply time and project management skills
Module contents	Safety Critical Computer Systems – Lectures Safety Critical Computer Systems - Exercises

Module teaching methods	Lectures: Interactive Teaching Exercises: Teamwork in small development groups
Module language	English
Module availability	Each semester

Module 2

Module title	Advanced Formal Modeling
Module number	2
Study program	High Integrity Systems (M.Sc.)
Module usability	Other Computer Science Master programs
Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory module
ECTS (CP) / Workload (h)	5 CP / 150 h
Module prerequisites	None
Module examination requirements	Laboratory exercises with written assignment (processing time: 80 hours)
Module examination	Written computer-based examination (90 minutes)
Learning outcomes and skills	The module provides an insight into the theory and practice of formal modeling. It focuses on the role of logic in deductive software verification and in knowledge representation. In this module the students learn how to model formal properties of software and prove its correctness using logic. They learn how to model knowledge using logic-based knowledge representation formalisms. Main goals are: • Understanding the use of different logics in formal modeling. • Understanding the logical foundations of formal methods and logic-based knowledge representation formalisms. • Ability to prove correctness of simple code fragments. • Ability to formalize and reason using logic. • Obtaining practical skills in using a theorem prover and a for- mal verification tool. • Understanding the limitations of logic. • Non specialist competencies: Scientific working style

Module contents	Advanced Formal Modeling – Lectures Advanced Formal Modeling – Exercises
Module teaching methods	Lectures, Exercises
Module language	English
Module availability	Winter semester

Module 3

Module title	Introductory Data Analysis
Module number	3
Study program	High Integrity Systems (M.Sc.)
Module usability	None
Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory module
ECTS (CP) / Workload (h)	5 CP/150 h
Module prerequisites	None
Module examination requirements	Laboratory exercises with written assignment (processing time 74 hours) written exposé (processing time 6 hours)
Module examination	Written computer-based examination (90 minutes)
Learning outcomes and skills	• Confident assessment of the usage of the various methods of univariate and bivariate statistics in the application context. • Knowledge and understanding of different probability concepts (distributions, statistical models, testing procedures and principles) • Capacity to apply methods to selected real world situations • Capacity to use the computer to solve problems in real world situations • Capacity to understand and judge results of statistical analysis • Awareness of dangers of misuse and misinterpretation • Capacity to communicate using statistical language, i.e. explain procedures, results of an analysis and a critique of the results • Scientific work style
Module contents	Introductory Data Analysis – Lectures Introductory Data Analysis – Exercises
Module teaching methods	Lectures using multimedia presentation techniques Exercises on PC using spreadsheets and statistical software tool
Module language	English
Module availability	Winter semester

Module 4.1

Module title	Advanced Real Time Systems
Module number	4.1
Study program	High Integrity Systems (M.Sc.)
Module usability	Barrierefreie Systeme (M.Sc.), Computer Science Master "Allgemeine Informatik"
Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP/ 150h
Module prerequisites	None
Module examination requirements	None
Module examination	Project (submission period 8 weeks) with presentation (min. 10, max. 20 minutes)
Learning outcomes and skills	• Extending the basic knowledge of real-time systems by reading a typical real-time research-paper • Transfering the knowledge into theoretical model solving a concrete problem • Transfering the theoretical model into a working software • Validating the software • Cultural and social aspects of project work in international R&D teams • Presentation skills • Team leading skills • Cultural and social aspects of project work in international R&D teams • Scientific literature research and handling • Writing a paper • Time and project management skills • Project documentation
Module contents	Advanced Real Time Systems-Project
Module teaching methods	After an introduction the student teams will work in a project setting. They have to use official textbooks and/ or scientific papers to back up their knowledge. The professor can be interviewed on demand.

Module language	English
Module availability	Winter semester

Module 4.2

Module title	Machine Learning
Module number	4.2
Study program	High Integrity Systems (M.Sc.)
Module usability	Barrierefreie Systeme (M.Sc.), Allgemeine Informatik (M.Sc.)
Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP/ 150h
Module prerequisites	None
Module examination requirements	None
Module examination	Written examination (90 minutes)
Learning outcomes and skills	Professional expertise: The students acquire a basic understanding of a standard approach in the field of machine learning, the general terminology and the principles of the field. In addition they get a practical understanding of the relevant mathematical, statistical and numerical aspects of the field with respect to applications. The students are capable • to apply this knowledge independently for problems in different application area, and • to implement it on an appropriate software platform. Personal expertise: The students are self-reliantly able to elaborate on complex theoretical models and to follow the state-of-the-art of the research field. They are capable to present worked-out solution strategies as well to experts of the field as to members of other disciplines. Because of the complexities of the requirements they are able to employ an effizient and evolutionary approach keeping the target in sight.

Module contents	Machine Learning - Lectures Machine Learning - Exercises
Module teaching methods	Lectures with exercises
Module language	English
Module availability	Winter semester

Module 5

Module title	Implementation of Data Base Management Systems (DBMS)
Module number	5
Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science Master programs
Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory module
ECTS (CP) / Workload (h)	5 CP/ 150 h
Module prerequisites	None
Module examination requirements	None
Module examination	Written examination (90 minutes)
Learning outcomes and skills	Upon completion of this course, the student is able to: • Understand why databases form the backbone of every modern information system, and why a robust database management system (DBMS) is crucial for these systems. • Decide which architectures and implementation issues are relevant for robust DBMS. • Comprehend prerequisites for building and extending a DBMS as well as for building the DBMS part of a larger application in a robust fashion. • Assess the role of available parameters of commercial DBMS and thus, be able to tune these parameters in a way that results in a robust and best performing system. • Working in teams • Communication in international teams
Module contents	Implementation of DBMS – lectures Implementation of DBMS - exercises
Module teaching methods	Interactive lectures Teamwork in laboratory exercises
Module language	English
Module availability	Winter semester

Module 6.1

Module title	Pattern Oriented Software Architecture
Module number	6.1
Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science Master programs
Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP/ 150h
Module prerequisites	None
Module examination requirements	None
Module examination	Oral examination (min. 15, max. 45 minutes)
Learning outcomes and skills	• understand the motives of the pattern community. • distinguish between different types of patterns. • apply patterns in the design of SCS. • assess new developments of pattern catalogs and languages. • team work: Students acquire the ability to work with others toward a same goal, participating actively, sharing responsibility and rewards, and contributing to the capability of the teamwork. • communication in international teams
Module contents	Pattern Oriented Software Architecture – Lectures Pattern Oriented Software Architecture – Exercises
Module teaching methods	Interactive lectures Laboratory exercises in teamwork
Module language	English
Module availability	Winter semester

Module 6.2

Module title	Quantum Information Science
Module number	6.2
Study program	High-Integrity Systems (M.Sc.)
Module usability	Other computer science Master programs
Module duration	One Semester
Recommended semester	1st /2nd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP / 150 h
Module prerequisites	None
Module examination requirements	None
Module examination	Oral examination (min. 15, max. 45 minutes)
Learning outcomes and skills	After having successful passed of this module, students are able • to describe the fundamental concepts and methods in Quantum Information Science, • to name the different building blocks, to explain their duties and functionality and to describe them in a formal mathematical manner, • to elucidate selected algorithms for this computational model, • to analyze, modify and apply existing quantum algorithms by using mathematical and computation foundations, • to constitute current forms of relevant quantum-systems
Module contents	Quantum Information Science Lectures Quantum Information Science Exercises
Module teaching methods	On-Site Lecture, with up to 60% parts may be online, exercises, homework, reading assignments
Module language	English
Module availability	Winter semester

Module 7

Module title	Mathematics Update
Module number	7
Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science Master programs
Module duration	One semester
Recommended semester	2nd semester
Module type	Compulsory module
ECTS (CP) / Workload (h)	5 CP/ 150h
Module prerequisites	None
Module examination requirements	None
Module examination	Written examination (90 minutes)
Learning outcomes and skills	• analyze mathematical problems in a software project's list of requirements • to familiarize with new mathematical fields • assess the suitability and usability of mathematical software tools
Module contents	Mathematics Update – Lectures Mathematics Update – Exercises
Module teaching methods	Interactive Lectures Exercises with teamwork in small groups
Module language	English
Module availability	Summer semester (for students starting in the winter semester) Winter semester (for students starting in the summer semester)

Module 8.1

Module title	Advanced Distributed Systems
Module number	8.1
Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science Master programmes
Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5CP/ 150h
Module prerequisites	None
Module examination requirements	None
Module examination	Written examination (90 minutes)
Learning outcomes and skills	• Understand the advantages and problems of distributed systems. • Knowledge of different distributed architectures and algorithms. • Ability to analyze distributed systems, in particular with respect to robustness.
Module contents	Advanced Distributed Systems – Lectures Advanced Distributed Systems – Exercises
Module teaching methods	Interactive Group Lecturing Teamwork exercises in small groups
Module language	English
Module availability	Summer semester

Module 8.2

Module title	Advanced Testing Methods
Module number	8.2
Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science Master programmes
Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP/ 150 h
Module prerequisites	None
Module examination requirements	None
Module examination	Written examination (90 minutes)
Learning outcomes and skills	Upon completion of this course, the student is able to: • assess different testing methodologies, • master various powerful testing procedures, • differentiate between the testing of procedural and object oriented software, • estimate the importance of safety criteria for test case design, • recognize the limits of testing capabilities, • use gained experience to select valuable automated tests, • recognize tests not to be automated. This module facilitates communication structures used in business like Wikis and Discussion boards to show challenges working in global teams.
Module contents	Advanced Testing Methods – Lectures Advanced Testing Methods – Exercises
Module teaching methods	Interactive group lecturing Teamwork in small groups
Module language	English
Module availability	Summer semester

Module 9

Module title	Advanced IT-Security
Module number	9

Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science Master programmes
Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory module
ECTS (CP) / Workload (h)	5 CP/ 150 h
Module prerequisites	None
Module examination requirements	None
Module examination	Written examination (120 minutes)
Learning outcomes and skills	Upon completion of this course, the student is able to: • to identify, analyze, and perhaps solve network-related security problems in computer systems. • to understand security problems in the combination of the Internet with Intranets. • to comprehend the need to protect all architectural levels. • to get an understanding of how to coordinate hardware and software to provide data security against internal and external attacks. • to communicate in international teams
Module contents	Advanced IT-Security – Lectures Advanced IT-Security – Exercises
Module teaching methods	Interactive Group Lecturing Teamwork Exercises in small groups
Module language	English
Module availability	Summer semester

Module 10.1

Module title	Human Machine Interaction
Module number	10.1
Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science Master programmes, particularly Barrierefreie Systeme (M.Sc.)
Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP/ 150 h
Module prerequisites	None
Module examination requirements	None
Module examination	Project (submission period 8 weeks) with presentation (min. 10, max. 20 minutes)
Learning outcomes and skills	• Overall goal is to gain basic knowledge about HMI as part of a systems engineering process, psychological conditions of a user, how to describe the behavior of the user, how to derive requirements for an interface, and how to test the usability of an interface • Transferring the gained knowledge into a theoretical model solving a concrete problem • Transferring the theoretical model into a working demonstrator • Working with others toward a same goal, and contributing to the capability of the teamwork. • Creating an atmosphere of respect, helpfulness and cooperation. • Validating the demonstrator with the aid of usability tests • Cultural and social aspects of project work in international R&D teams • Presentation skills • Team leading skills • Documentation • Writing a scientific paper
Module contents	Human Machine Interaction - Project
Module teaching methods	After an introduction the student teams work in a project. They

	have to use official textbooks and/ or scientific papers to back up their knowledge. The professor can be interviewed on demand
Module language	English
Module availability	Summer semester

Module 10.2

Module title	Smart Sensor Network Systems
Module number	10.2
Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science Master programmes, particularly Barrierefreie Systeme (M.Sc.), Allgemeine Informatik (M.Sc.)
Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP/ 150 h
Module prerequisites	None
Module examination requirements	None
Module examination	Project (submission period 8 weeks) with presentation (min. 10, max. 20 minutes)
Learning outcomes and skills	• understand the interface between computer science and the physical environment, • assess the challenges of the measuring process and the possible errors, • set up and program a Wireless Sensor Network and interface it with a standard network and/or the Internet, • participate in the solution of measuring tasks by cooperation with specialists of other disciplines • Cultural and social aspects of project work in international R&D teams • Presentation skills • Team leading skills • Documentation • Writing a scientific paper
Module contents	Smart Sensor Network Systems – Project
Module teaching methods	Project
Module language	English
Module availability	Summer semester

Module 11

Module title	Data Mining Methods
Module number	11
Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science Master programmes
Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory module
ECTS (CP) / Workload (h)	5CP/ 150 h
Module prerequisites	None
Module examination requirements	Software Exercises with documentation (processing time 80 hours)
Module examination	Written computer-based examination (90 minutes)
Learning outcomes and skills	• Awareness of different data types, data scales, data use as endogenous and exogenous • Skills in data recovery and data pre-processing • Theoretical understanding of statistical methods for information extraction • Capacity to use the computer to solve problems in real world data mining problems • Capacity to understand and judge results of statistical analysis in the context of data mining • Awareness of dangers of misuse and misinterpretation • Capacity to communicate using statistical language, i.e. explain procedures, results of an analysis and a critique of the results • Communication in international teams
Module contents	Data Mining Methods - Lectures Data Mining Methods - Exercises
Module teaching methods	Lectures using multimedia presentation techniques Exercises with a PC and statistical programming language in Computer pool to solve problems
Module language	English
Module availability	Summer semester

Module title	System Theory and Modeling
Module number	12.1
Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science Master programmes

Module 12.1

Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5CP/ 150h
Module prerequisites	None
Module examination requirements	None
Module examination	Written examination (90 minutes)
Learning outcomes and skills	• Understand the foundations of systems theory, • comprehend the importance of HW/SW system modeling, • assess different modeling techniques, • apply system modeling techniques to real world application prototype examples. • Scientific literature research and handling
Module contents	System Theory and Modeling – Lectures System Theory and Modeling - Exercises
Module teaching methods	Interactive lectures using multimedia presentation techniques Exercises: Teamwork
Module language	English.
Module availability	Summer semester

Module 12.2

Module title	Transaction Management
Module number	12.2
Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science Master programmes
Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP/ 150 h
Module prerequisites	None
Module examination requirements	None
Module examination	Written examination (90 minutes)
Learning outcomes and skills	• Understanding the concept of a transaction. • Understanding how the deployment of transaction systems can increase the robustness of a system without adding additional complexity to the application development. • Knowledge of algorithms to handle problems resulting from concurrent access to data and errors resulting from system failures. • Scientific literature research and handling
Module contents	Transaction Management – Lectures Transaction Management – Exercises
Module teaching methods	Interactive lectures Exercises: Teamwork in R&D-groups
Module language	English
Module availability	Summer semester

Module 12.3

Module title	Learning from Data
Module number	12.3
Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science Master programms
Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP/ 150 h
Module prerequisites	None
Module examination requirements	None
Module examination	Written project report (submission period 6 weeks) with presentation (min. 15, max. 45 minutes)
Learning outcomes and skills	Professional expertise: The students gain a principal understanding of the mathematical and epistemological basics of statistical learning theory and machine learning. They are capable to independently apply their knowledge in various problem fields, e.g. robotics, big data etc. In addition they know the most important application fields of statistical learning theory and are able to assess the ethical and societal dimensions of applications. The students have the opportunity to test their findings in a prototype on a relevant platform and write a scientific paper. Personal expertise: The students are capable to independently work out complex theoretical models and to follow the state-of-the-art of current research. They are capable to write scientific publications and to present the results of their research for experts and lay persons alike.
Module contents	Learning for Data – Lectures Learning from Data – Exercises
Module teaching methods	Interactive lectures Exercises: Seminar
Module language	English
Module availability	Each semester

Module 13.1

Module title	Multivariate Data Analysis
Module number	13.1
Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science Master programmes
Module duration	One semester
Recommended semester	3rd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP/ 150 h
Module prerequisites	None
Module examination requirements	Laboratory exercises with written assignment (total processing time 74 hours) written exposé (processing time 6 hours)
Module examination	Written computer-based examination (90 minutes)
Learning outcomes and skills	• Understanding of structure of data from automated processes • Understanding of Data pre-processing methods (data compression, data alignment, data transformations etc.) • Understanding of collinearity problem and ways to deal with it • Capacity to apply technologies to real world situations • Capacity to analyse a data analysis project, determine pre-processing steps, try out different statistical technologies • Interpret results in the context of an application and a given problem setting • Draw conclusions and communicate results and procedures of a data analysis project • Scientific literature research and handling
Module contents	Multivariate Data Analysis – Lectures Multivariate Data Analysis - Exercises
Module teaching methods	Lectures using multimedia presentation techniques Group work
Module language	English
Module availability	Each semester

Module 13.2

Module title	Simulation Methods
Module number	13.2
Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science Master programmes
Module duration	One semester
Recommended semester	3rd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5CP/ 150 h
Module prerequisites	None
Module examination requirements	Laboratory exercises(total processing time 80 hours)
Module examination	Written examination (90 minutes)
Learning outcomes and skills	Upon completion of this course, the student is able to: • assess the growing importance of simulation for high-integrity systems, • understand the interaction between simulation and experimental verification, • get an overview over simulation methods, • get experience in using simulation tools, recognize the limitations of simulation work.
Module contents	Simulation Methods – Lectures Simulation Methods - Exercises
Module teaching methods	Interactive lectures using multimedia presentation techniques Exercises: Teamwork
Module language	English
Module availability	Summer semester

Module 13.3

Module title	Artificial Intelligence
Module number	13.3
Study program	High Integrity Systems (M.Sc.)
Module usability	Barrierefreie Systeme (M.Sc.), Computer Science Master “Allgemeine Informatik”
Module duration	One semester
Recommended semester	1st /2nd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP/ 150h
Module prerequisites	None
Module examination requirements	None
Module examination	Written examination (90 minutes)
Learning outcomes and skills	Professional expertise: The students acquire a basic understanding of problems, methods and techniques for the development and assessment of Artificial Intelligence (AI) systems. This includes knowledge of classical and state-of-the-art theoretical models of symbolic artificial intelligence and of software systems for the implementation of learned methods and algorithms. The students are capable • to independently design AI-based solutions for problems in different application areas, • to comprehend the functioning of selected learning algorithms and to independently implement those, and • to employ common software solutions for deliberate implementation of their design ideas. Personal expertise: The students are capable to present and defend worked-out solution strategies as well to experts of the field as to members of other disciplines. They understand the basics of scientific work, master literature research and scientific presentation methods and use the e-learning platform.

Module contents	Artificial Intelligence - Lectures Artificial Intelligence - Exercises
Module teaching methods	Lectures with exercises
Module language	English
Module availability	Each semester

Module 14.1

Module title	Standards and Certification
Module number	14.1
Study program	High Integrity Systems (M.Sc.)
Module usability	None
Module duration	One semester
Recommended semester	3rd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP/ 150h
Module prerequisites	None
Module examination requirements	None
Module examination	Project (submission period 8 weeks) with oral presentation (min. 20 , max. 30 minutes)
Learning outcomes and skills	Students will be able to • assess the growing pressure to standardize the development of high-integrity systems, • understand the growing importance of software safety, • survey the body of standards, • distinguish between standards of different application fields, • understand the history of engineering for safety, • achieve the ability for certification work, • understand the roles of management and staff in certification work. • learn to search for, read, summarize and cite scientific literature on a large scale; • read and interpret national and international standards; • write a report as a scientific paper; • give a scientific talk.
Module contents	Certification and Standards – Seminar
Module teaching methods	Seminar
Module language	English
Module availability	Alternating with modules 14.2, 14.3, summer and winter semester

Module 14.2

Module title	Current Topics in High Integrity Systems
Module number	14.2
Study program	High Integrity Systems (M.Sc.)
Module usability	None
Module duration	One semester
Recommended semester	3rd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP/ 150h
Module prerequisites	None
Module examination requirements	None
Module examination	Project (submission period 8 weeks) with oral presentation (min. 20 , max. 30 minutes)
Learning outcomes and skills	• recognize important developments in the field of High Integrity Systems, • incorporate new methods into the software and systems development process • criticize new technology with respect to their usability in critical systems development. • to search for, read, summarize and cite scientific literature on a large scale; • to read and interpret national and international publications • to write a report as a scientific paper; to give a scientific talk.
Module contents	Current Topics in High Integrity Systems – Seminar
Module teaching methods	Seminar
Module language	English
Module availability	Alternating with modules 14.1, 14.3, summer and winter semester

Module 14.3

Module title	Internet of Things
Module number	14.3
Study program	High Integrity Systems (M.Sc.)
Module usability	n/a
Module duration	One semester
Recommended semester	3rd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP/ 150h
Module prerequisites	None
Module examination requirements	None
Module examination	Project (submission period 8 weeks) with oral presentation (min. 20 , max. 30 minutes)
Learning outcomes and skills	• understand the basic technologies for the Internet of Things, • asses emerging technologies concerning their suitability, • get acquainted quickly with new technologies, and • develop new application fields. • to search for, read, summarize and cite scientific literature on a large scale; • to read and interpret national and international standards; • to write a report as a scientific paper; • to give a scientific talk.
Module contents	Internet of Things – Seminar
Module teaching methods	Seminar
Module language	English
Module availability	Annually

Module 15

Module title	Formal Specification and Verification
Module number	15
Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science Master programmes
Module duration	One semester
Recommended semester	3rd semester
Module type	Compulsory module
ECTS (CP) / Workload (h)	5 CP/ 150 h
Module prerequisites	None
Module examination requirements	None
Module examination	Written computer-based examination (90 minutes)
Learning outcomes and skills	Understanding the principles of formal specification and verification. Understanding the theory (models and logics) used in model checking. Reasoning about safety, liveness and fairness properties in concurrent systems. Specifying safety and liveness properties of concurrent systems using temporal logic and/or computational tree logic. Verifying that a concurrent system satisfies certain safety and liveness properties using model checking algorithms. Obtaining practical skills in using a Model Checking Tool . Understanding the limitations of model checking. Non specialist competencies: Communication in international teams
Module contents	Formal Specification and Verification – Lectures Formal Specification and Verification – Exercises
Module teaching methods	Lectures Exercises
Module language	English

Module availability	Each semester

Module 16.1

Module title	Selected Subjects in Current Web Engineering
Module number	16.1
Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science and engineering Master programmes
Module duration	One semester
Recommended semester	3rd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP/ 150 h
Module prerequisites	None
Module examination requirements	None
Module examination	Written examination (90 minutes)
Learning outcomes and skills	Web architectures play an important and ever increasing role in organizing IT on a large scale. Web applications and algorithms have an important impact on society and how information is processed and consumed. At the end of the course the students will • have a *basic* understanding of the fundamental principles of Web Engineering, such as Web-protocols and architectures, relevant algorithms, data semantics and (Web-) UI and how these relate to each other • be able to plan and architect information systems based on those principles • have a *deep* understanding of at least one selected subject from Web-protocols and architecture, relevant algorithms, data semantics and (Web-) UI (depending on the actual lecture and the student's interest)
Module contents	Selected Subjects in Current Web Engineering - Lectures Selected Subjects in Current Web Engineering - Exercises
Module teaching methods	Lectures Exercises
Module language	English

Module availability	Each semester

Module 16.2

Module title	Mobile Systems and Applications
Module number	16.2
Study program	High Integrity Systems (M.Sc.)
Module usability	Other computer science and engineering Master programmes
Module duration	One semester
Recommended semester	3rd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP/150 h
Module prerequisites	None
Module examination requirements	None
Module examination	Written examination (90 minutes)
Learning outcomes and skills	• understand the role and specific challenges of mobile computing • understand the foundations of mobile computing including theoretical concepts, technologies and tools • are able to apply their skills and choose technologies accordingly • are able to develop and deploy mobile applications
Module contents	Mobile Systems and Applications – Lectures Mobile Systems and Applications – Exercises
Module teaching methods	Lectures Exercises
Module language	English
Module availability	Each semester

Module 16.3

Module title	Cloud Computing
Module number	16.3
Study program	High Integrity Systems (M.Sc.)
Module usability	Cloud Computing – Lectures Cloud Computing – Exercises
Module duration	One semester
Recommended semester	3rd semester
Module type	Compulsory elective module
ECTS (CP) / Workload (h)	5 CP/ 150 h
Module prerequisites	None
Module examination requirements	None
Module examination	Written examination (90 minutes)
Learning outcomes and skills	Upon completion of this course, the students • understand the concepts and technologies fundamental for Cloud Computing • understand the economical and operational impact of Cloud Computing for providing IT-resources within the enterprise • is able to apply a structured, scientific process to evaluate architecture alternatives for Cloud Computing • are able to architect and implement Cloud Computing solutions.
Module contents	Cloud Computing – Lectures Cloud Computing – Exercises
Module teaching methods	Lectures Exercises
Module language	English
Module availability	Each semester

Module 17

Module title	High Integrity Systems Project
Module number	17
Study program	High Integrity Systems (M.Sc.)
Module usability	n/a
Module duration	One semester
Recommended semester	3rd semester
Module type	Compulsory module
ECTS (CP) / Workload (h)	10 LP/ 300 h
Module prerequisites	None
Module examination requirements	None
Module examination	Project (submission period 8 weeks) with presentation (min. 20, max. 30 minutes)
Learning outcomes and skills	• develop a high-integrity software application with real-world requirements, • gain experience in all fields of software eand systems engineering and certification of high-integrity software, • and assess the problems of applying scientific knowledge in a real world R&D – situation. • to explore and to adapt to a R&D environment; • to organize a research team; • to use modern tools for project organization; • to make industrial presentations; • work in a group environment with distributed responsibilities; • to write a report as a scientific paper.
Module contents	High Integrity Systems – Project
Module teaching methods	Project
Module language	English
Module availability	Each semester

Module 18

Module title	Master Thesis with Colloquium
Module number	18
Study program	High Integrity Systems (M.Sc.)
Module usability	None
Module duration	20 weeks
Recommended semester	4th semester
Module type	Compulsory module
ECTS (CP) / Workload (h)	30 CP/ 900 h
Module prerequisites	Successful completion of all modules of the first three semesters of the study programme
Module examination requirements	Successful completion of all modules of the first three semesters of the study programme
Module examination	Master- Thesis (processing time: 20 weeks) with Colloquium (min. 30, max. 60 minutes)
Learning outcomes and skills	• develop completely an extensive high-integrity software application with real-world requirements, • work in a larger group environment with distributed responsibilities, • gain experience in all fields of software engineering and certification of high-integrity software, • and assess the problems of applying scientific knowledge in a real world R&D – situation. • practice scientific project management;. • use modern tools for project organization; • write the thesis as a comprehensive scientific report; • defend the thesis in a scientific colloquium
Module contents	Research and Development project
Module teaching methods	Thesis and colloquium
Module language	English
Module availability	Each semester

DIPLOMA SUPPLEMENT

This Diploma Supplement model was developed by the European Commission, Council of Europe and UNESCO/CEPES. The purpose of the supplement is to provide sufficient independent data to improve the international 'transparency' and fair academic and professional recognition of qualifications (diplomas, degrees, certificates etc.). It is designed to provide a description of the nature, level, context, content and status of the studies that were pursued and successfully completed by the individual named on the original qualification to which this supplement is appended. It should be free from any value judgements, equivalence statements or suggestions about recognition. Information in all eight sections should be provided. Where information is not provided, an explanation should give the reason why.

1. INFORMATION IDENTIFYING THE HOLDER OF THE QUALIFICATION

1.1 Family Name / 1.2 First Name

<<Nachname>>, <<Vorname>>

1.3 Date, Place, Country of Birth

<<TT. MMMM YYYY>>, <<Geburtsort>>, <<Geburtsland>>

1.4 Student ID Number or Code

<<Matrikel-Nummer>>

2. INFORMATION IDENTIFYING QUALIFICATION

2.1 Name of Qualification / Title conferred (in original language)

High Integrity Systems (Master of Science)

2.2 Main Field(s) of Study

High Integrity Systems (Master of Science)

2.3 Name and status of awarding institution (in original language)

Frankfurt University of Applied Sciences
Faculty of Computer Science and Engineering
University of Applied Sciences, State Institution

2.4 Name and status of institution administering studies (in original language)

See 2.3

2.5 Language(s) of Instruction/Examination

English (120 credits [ECTS])

3. INFORMATION ON THE LEVEL AND DURATION OF THE QUALIFICATION

3.1 Level of the qualification

Second level degree with Master-Thesis

3.2 Official duration of programme in credits and years

2 years = 4 semesters, 120 credit points (ECTS)

3.3 Access requirements

First academic degree or equivalent

4. INFORMATION ON THE PROGRAMME COMPLETED AND THE RESULTS OBTAINED

4.1 Mode of Study

Full-time

4.2 Programme learning outcomes

The description of the qualification goals follows the Qualifications Framework for German Higher Education Qualifications for the Master's level and contains the categories Knowledge Broadening, Knowledge Deepening, Knowledge Understanding, Use and Transfer, Scientific Innovation, Communication and Cooperation as well as Scientific Self-Conception.

Knowledge Broadening
The graduates have advanced knowledge of computer science related to the development and research of critical systems and are able to participate in the current scientific and technical developments in the field.

Knowledge Deepening
The graduates master techniques of scientific writing and scientific presentation, instruments of self- and project management in all phases of the development of software-supported, critical systems, as well as scientific information acquisition and processing, including all relevant software tools. They have learned to formulate requirements, problems and results of their work in English. Depending on the chosen elective modules, they master the essential methods of requirements analysis, design, implementation, testing and quality assurance, and certification of safety-critical, mission-critical and business-critical computer-aided systems. The acquired methods qualify the graduates for the desired professional fields (research and development, quality assurance, consulting, project management, management). They know the basics of related fields and incorporate this knowledge into their work. They are aware of the ethical and social effects of their activities.

Knowledge Understanding
In solving concrete research and development tasks, they apply their knowledge, recognise the limits of technologies and science and are able to assess and evaluate them in line with requirements. In doing so, they apply the specialist knowledge and experience they have acquired during their studies in theoretical and practice-oriented modules, depending on the elective modules selected.

Use and transfer
Graduates are able to obtain relevant information, process it and make informed decisions based on it. They know the relevant organisational and team structures and team dynamics and are able to successfully work on a common task within a team.

Scientific Innovation
Graduates are able to assess the requirements of a technical/scientific task, research and develop solutions and implement them independently. They can derive open questions and develop new approaches based on the current state of research. Within the framework of project work and the master's thesis, they have learned to document their results scientifically, to present them and to justify them to a specialist audience.

Communication and Cooperation
The graduates are able to familiarize themselves with foreign fields of study and science and to find solutions for interdisciplinary problems together with experts from foreign fields of study. The graduates thus have both the interpersonal competence of working in a team with experts from their own discipline and the interdisciplinary teamwork. In the course of various work situations

during their studies, they have acquired cooperative learning and work behaviour.

Scientific self-image/ professionalism
The graduates recognize the requirements of companies, state organizations and society for the development of critical systems. They are prepared to assume project or leadership responsibility. They develop their sensitivity for the ways of thinking of foreign disciplines and learn to make technical and scientific contexts understandable within the framework of different scientific disciplines.
The insight they have gained in their specialist discipline and in an interdisciplinary manner prepares them in particular to request more in-depth specialist expertise and to integrate it into their tasks. They thus possess the corresponding competences, which qualify them for independent work in computer science.
The graduates recognise and reflect on the professional requirements placed on them as well as their professional responsibility for people, society and ecology.

4.3 Programme details, individual credits gained and grades/marks obtained

See “Transcript of records” and “Prüfungszeugnis” (Final Examination Certificate) for the list of courses and grades, as well as the topic and grade of the final thesis.

4.4 Grading system and, if available, grade distribution table

See general grading scheme cf. Sec. 8.6.
Grade distribution tables as described in the ECTS Users’ Guide: The calculation only takes place if the reference group consists of at least 50 graduates.

4.5 Overall Classification of the qualification (in original language)

Beispiel: The result of the <Bachelor/Master> Examination is based on the accumulation of grades received during the study program and the “<Bachelor/Master>-Thesis with Colloquium” (See „Transcript of Records” for details).

5. INFORMATION ON THE FUNCTION OF THE QUALIFICATION

5.1 Access to Further Study

Master-level: qualifies for PhD studies

5.2 Access to a regulated profession (if applicable)

Qualifies to apply for admission to the German “Höherer Dienst”

6. ADDITIONAL INFORMATION

6.1 Additional Information

The programme is fully taught in English

6.2 Further information sources

On the institution: www.frankfurt-university.de
On the programme: https://www.frankfurt-university.de/en/studies/master-programs/high-integrity-systems-msc/prospective-students/
For national information sources cf. Sect. 8.8

7. CERTIFICATION

This Diploma Supplement refers to the following documents:
Degree issued: …
Certificate issued: …
Transcript of records issued: …
Certification Date:
Chairperson Examination Committee
Official Stamp/Seal

8. INFORMATION ON THE GERMAN HIGHER EDUCATION SYSTEM

The information on the national higher education system on the following pages provides a context for the qualification and the type of higher education that awarded it.

8.1 Types of Institutions and Institutional Status

Higher education (HE) studies in Germany are offered at three types of Higher Education Institutions (HEI).
- Universitäten (Universities) including various specialised institutions, offer the whole range of academic disciplines. In the German tradition, universities focus in particular on basic research so that advanced stages of study have mainly theoretical orientation and research-oriented components.
- Fachhochschulen (FH)/Hochschulen für Angewandte Wissenschaften (Universities of Applied Sciences, UAS) concentrate their study programmes in engineering and other technical disciplines, business-related studies, social work, and design areas. The common mission of applied research and development implies an application-oriented focus of studies, which includes integrated and supervised work assignments in industry, enterprises or other relevant institutions.
- Kunst- und Musikhochschulen (Universities of Art/Music) offer studies for artistic careers in fine arts, performing arts and music; in such fields as directing, production, writing in theatre, film, and other media; and in a variety of design areas, architecture, media and communication.
Higher Education Institutions are either state or state-recognised institutions. In their operations, including the organisation of studies and the designation and award of degrees, they are both subject to higher education legislation.

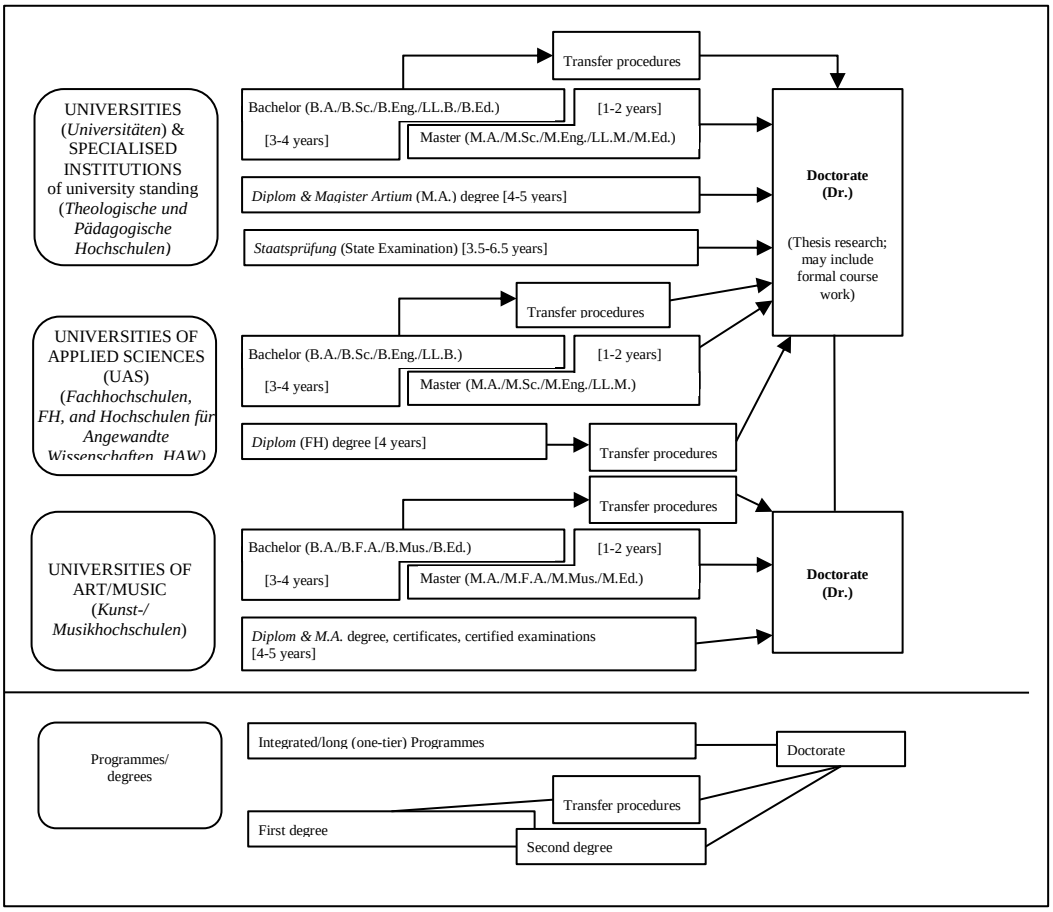
8.2 Types of Programmes and Degrees Awarded

Studies in all three types of institutions have traditionally been offered in integrated "long" (one-tier) programmes leading to Diplom- or Magister Artium degrees or completed by a Staatsprüfung (State Examination).
Within the framework of the Bologna-Process one-tier study programmes are successively being replaced by a two-tier study system. Since 1998, two-tier degrees (Bachelor and Master) have been introduced in almost all study programmes. This change is designed to provide enlarged variety and flexibility to students in planning and pursuing educational objectives, it also enhance international compatibility of studies.
The German Qualifications Framework for Higher Education Qualifications (HQR) describes the qualification levels as well as the resulting qualifications and competences of the graduates. The three levels of the HQR correspond to the levels 6, 7 and 8 of the German Qualifications Framework for Lifelong Learning and the European Qualifications Framework for Lifelong Learning .
For details cf. Sec. 8.4.1, 8.4.2, and 8.4.3 respectively. Table 1 provides a synoptic summary.

8.3 Approval/Accreditation of Programmes and Degrees

To ensure quality and comparability of qualifications, the organization of studies and general degree requirements have to conform to principles and regulations established by the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (KMK). In1999, a system of accreditation for Bachelor and Master’s programmes has become operational. All new programmes have to be accredited under this scheme; after a successful accreditation they receive the seal of the Accreditation Council.

Table 1: Institutions, Programmes and Degrees in German Higher Education



8.4 Organisation and Structure of Studies

The following programmes apply to all three types of institutions. Bachelor's and Master's study courses may be studied consecutively, at various higher education institutions, at different types of higher education institutions and with phases of professional work between the first and the second qualification. The organisation of the study programmes makes use of modular components and of the European Credit Transfer and Accumulation System (ECTS) with 30 credits corresponding to one semester.

8.4.1 Bachelor

Bachelor's degree programmes lay the academic foundations, provide methodological competences and include skills related to the professional field. The Bachelor's degree is awarded after 3 to 4 years.
The Bachelor's degree programme includes a thesis requirement. Study programmes leading to the Bachelor's degree must be accredited according to the Interstate study accreditation treaty. First degree programmes (Bachelor) lead to Bachelor of Arts (B.A.), Bachelor of Science (B.Sc.), Bachelor of Engineering (B.Eng.), Bachelor of Laws (LL.B.), Bachelor of Fine Arts (B.F.A.), Bachelor of Music (B.Mus.) or Bachelor of Education (B.Ed.).
The Bachelor's degree corresponds to level 6 of the German Qualifications Framework/ European Qualifications Framework.

8.4.2 Master

Master is the second degree after another 1 to 2 years. Master's programmes may be differentiated by the profile types "practice-oriented" and "research-oriented". Higher Education Institutions define the profile.
The Master's degree programme includes a thesis requirement. Study programmes leading to the Master's degree must be accredited according to the Interstate study accreditation treaty. Second degree programmes (Master) lead to Master of Arts (M.A.), Master of Science (M.Sc.), Master of Engineering (M.Eng.), Master of Laws (L.L.M.), Master of Fine Arts (M.F.A.), Master of Music (M.Mus.) or Master of Education (M.Ed.). Master´s programmes which are designed for continuing education may carry other designations (e.g. MBA).
The Master's degree corresponds to level 7 of the German Qualifications Framework/ European Qualifications Framework.

8.4.3 Integrated "Long" Programmes (One-Tier):

Diplom degrees, Magister Artium, Staatsprüfung
An integrated study programme is either mono-disciplinary (Diplom degrees, most programmes completed by a Staatsprüfung) or comprises a combination of either two major or one major and two minor fields (Magister Artium). The first stage (1.5 to 2 years) focuses on broad orientations and foundations of the field(s) of study. An Intermediate Examination (Diplom-Vorprüfung for Diplom degrees; Zwischenprüfung or credit requirements for the Magister Artium) is prerequisite to enter the second stage of advanced studies and specialisations. Degree requirements include

submission of a thesis (up to 6 months duration) and comprehensive final written and oral examinations. Similar regulations apply to studies leading to a Staatsprüfung. The level of qualification is equivalent to the Master's level.
- Integrated studies at Universitäten (U) last 4 to 5 years (Diplom degree, Magister Artium) or 3.5 to 6.5 years (Staatsprüfung). The Diplom degree is awarded in engineering disciplines, the natural sciences as well as economics and business. In the humanities, the corresponding degree is usually the Magister Artium (M.A.). In the social sciences, the practice varies as a matter of institutional traditions. Studies preparing for the legal, medical and pharmaceutical professions are completed by a Staatsprüfung. This applies also to studies preparing for teaching professions of some Länder.
The three qualifications (Diplom, Magister Artium and Staatsprüfung) are academically equivalent and correspond to level 7 of the German Qualifications Framework/European Qualifications Framework.
They qualify to apply for admission to doctoral studies. Further prerequisites for admission may be defined by the Higher Education Institution, cf. Sec. 8.5.
- Integrated studies at Fachhochschulen (FH)/Hochschulen für Angewandte Wissenschaften (HAW) (Universities of Applied Sciences, UAS) last 4 years and lead to a Diplom (FH) degree which corresponds to level 6 of the German Qualifications Framework/European Qualifications Framework.
Qualified graduates of FH/HAW/UAS may apply for admission to doctoral studies at doctorate-granting institutions, cf. Sec. 8.5.
- Studies at Kunst- and Musikhochschulen (Universities of Art/Music etc.) are more diverse in their organisation, depending on the field and individual objectives. In addition to Diplom/Magister degrees, the integrated study programme awards include certificates and certified examinations for specialised areas and professional purposes.

8.5 Doctorate

Universities as well as specialised institutions of university standing, some of the FH/HAW/UAS and some Universities of Art/Music are doctorate-granting institutions. Formal prerequisite for admission to doctoral work is a qualified Master's degree (UAS and U), a Magister degree, a Diplom, a Staatsprüfung, or a foreign equivalent. Comparable degrees from universities of art and music can in exceptional cases (study programmes such as music theory, musicology, pedagogy of arts and music, media studies) also formally qualify for doctoral work. Particularly qualified holders of a Bachelor's degree or a Diplom (FH) degree may also be admitted to doctoral studies without acquisition of a further degree by means of a procedure to determine their aptitude. The universities respectively the doctorate-granting institutions regulate entry to a doctorate as well as the structure of the procedure to determine aptitude. Admission further requires the acceptance of the Dissertation research project by a professor as a supervisor.
The doctoral degree corresponds to level 8 of the German Qualifications Framework/ European Qualifications Framework.

8.6 Grading scheme

The grading scheme in Germany usually comprises five levels (with numerical equivalents; intermediate grades may be given): "Sehr Gut" (1) = Very Good; "Gut" (2) = Good; "Befriedigend" (3) = Satisfactory; "Ausreichend" (4) = Sufficient; "Nicht ausreichend" (5) = Non-Sufficient/Fail. The minimum passing grade is "Ausreichend" (4). Verbal designations of grades may vary in some cases and for doctoral degrees.
In addition, grade distribution tables as described in the ECTS Users' Guide are used to indicate the relative distribution of grades within a reference group.

8.7 Access to higher education

The General Higher Education Entrance Qualification (Allgemeine Hochschulreife, Abitur) after 12 to 13 years of schooling allows for admission to all higher educational studies. Specialised variants (Fachgebundene Hochschulreife) allow for admission at Fachhochschulen (FH)/Hochschulen für Angewandte Wissenschaften (HAW) (UAS), universities and equivalent higher education institutions, but only in particular disciplines. Access to study programmes at Fachhochschulen (FH)/Hochschulen für Angewandte Wissenschaften (HAW) (UAS) is also possible with a Fachhochschulreife, which can usually be acquired after 12 years of schooling. Admission to study programmes at Universities of Art/Music and comparable study programmes at other higher education institutions as well as admission to a study programme in sports may be based on other or additional evidence demonstrating individual aptitude.
Applicants with a qualification in vocational education and training but without a school-based higher education entrance qualification are entitled to a general higher education entrance qualification and thus to access to all study programmes, provided they have obtained advanced further training certificates in particular state-regulated vocational fields (e.g. Meister/Meisterin im Handwerk, Industriemeister/in, Fachwirt/in (IHK), Betriebswirt/in (IHK) und (HWK), staatlich gebrüfte/r Techniker/in, staatlich geprüfte/r Betriebswirt/in, staatlich geprüfte/r Gestalter/in, staatlich geprüfte/r Erzieher/in). Vocationally qualified applicants can obtain a Fachgebundene Hochschulreife after completing a state-regulated vocational education of at least two years' duration plus professional practice of normally at least three years' duration, after having successfully passed an aptitude test at a higher education institution or other state institution; the aptitude test may be replaced by successfully completed trial studies of at least one year's duration.
Higher Education Institutions may in certain cases apply additional admission procedures.

8.8 National sources of information

- Kultusministerkonferenz (KMK) [Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany]; Graurheindorfer Str. 157, D-53117 Bonn;
Phone: +49[0]228/501-0; www.kmk.org; E-Mail: hochschulen@kmk.org
- Central Office for Foreign Education (ZAB) as German NARIC; www.kmk.org; E-Mail: zab@kmk.org
- German information office of the Länder in the EURYDICE Network, providing the national dossier on the education system; www.kmk.org; E-Mail: Eurydice@kmk.org
- Hochschulrektorenkonferenz (HRK) [German Rectors' Conference]; Leipziger Platz 11, D-10117 Berlin, Phone: +49 30 206292-11; www.hrk.de; E-Mail: post@hrk.de
- "Higher Education Compass" of the German Rectors' Conference features comprehensive information on institutions, programmes of study, etc. (www.higher-education-compass.de)

The information covers only aspects directly relevant to purposes of the Diploma Supplement.

[1] *Berufsakademien* are not considered as Higher Education Institutions, they only exist in some of the *Länder*. They offer educational programmes in close cooperation with private companies. Students receive a formal degree and carry out an apprenticeship at the company. Some *Berufsakademien* offer Bachelor courses which are recognised as an academic degree if they are accredited by the Accreditation Council.

[1] German Qualifications Framework for Higher Education Degrees. (Resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the *Länder* in the Federal Republic of Germany of 16 February 2017).

[1] German Qualifications Framework for Lifelong Learning (DQR). Joint resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the *Länder* in the Federal Republic of Germany, the German Federal Ministry of Education and Research, the German Conference of Economics Ministers and the German Federal Ministry of Economics and Technology (Resolution of the Standing Conference of the Ministers of

Education and Cultural Affairs of the *Länder* in the Federal Republic of Germany of 15 November 2012). More information at www.dqr.de

[1] Recommendation of the European Parliament and the European Council on the establishment of a European Qualifications Framework for Lifelong Learning of 23 April 2008 (2008/C 111/01 – European Qualifications Framework for Lifelong Learning – EQF).

[1] Specimen decree pursuant to Article 4, paragraphs 1 – 4 of the interstate study accreditation treaty (Resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany of 7 December 2017).

[1] Interstate Treaty on the organisation of a joint accreditation system to ensure the quality of teaching and learning at German higher education institutions (Interstate study accreditation treaty) (Decision of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany of 8 December 2016), Enacted on 1 January 2018.

[1] See note No. 7.

[1] See note No. 7.

[1] Access to higher education for applicants with a vocational qualification, but without a school-based higher education entrance qualification (Resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the *Länder* in the Federal Republic of Germany of 6 March 2009).