

Master's degree program

International Information Systems

Module handbook—summer semester 2021

**Advanced
knowledge**



(English version below)

Bitte beachten Sie:

Veränderungen des Lehrangebots bedingt durch COVID-19

Nachdem ein Ende der Pandemie im Sommersemester noch nicht absehbar ist, steuert der Fachbereich in der Organisation der Veranstaltungen nach. Hierfür wird das Konzept WiSo-Virtuell, welches als Antwort auf die Corona-Krise entwickelt wurde, in das Konzept WiSo-Virtuell^{plus} überführt.

Die Studierbarkeit aller Studiengänge ist durch die Digitalisierung aller Pflichtmodule gesichert. Darüber hinaus können ausgewählte Lehrveranstaltungen parallel zu digitalen Inhalten mit Präsenzelementen angereichert sein, die auf freiwilliger Basis besucht werden können. Der Wahlbereich wird neben digitalen Angeboten so strukturiert, dass Module in Teilen oder zur Gänze in Präsenzlehre stattfinden.

Die Studierenden können je nach ihren Bedürfnissen und ihrer persönlichen Lebenssituation entscheiden, ob sie digital studieren wollen oder aber an weiteren Angeboten des Präsenzlernens teilnehmen wollen: „Digitales/virtuelles Studium PLUS freiwillige Präsenzveranstaltungen für ausgewählte Lehrveranstaltungen“. Vorausgesetzt das Infektionsgeschehen im Laufe des Semesters lässt dies zu.

Die FAU hat eine Corona-Satzung aufgrund von Einschränkungen im Lehr- und Prüfungsbetrieb durch das Corona-Virus SARS-CoV-2 veröffentlicht. Das Modulhandbuch in der vorliegenden Fassung enthält Corona-bedingte Änderungen an der Prüfungsform, die in den jeweiligen Modulbeschreibungen gekennzeichnet sind.

Folgende Szenarien sind auf der Grundlage der Corona-Satzung möglich:

- **Prüfungsformate unverändert**
Das ursprünglich vorgesehene Prüfungsformat, z. B. eine Klausur bleibt bestehen. In diesen Modulbeschreibungen wurde keine Änderung vorgenommen.
- **Einmaliger Wechsel der Prüfungsform im Sommersemester**
Der Wechsel der Prüfungsformate ist möglich, wenn die ursprünglich geplante Prüfungsform auf Grund des Corona-Virus nicht umsetzbar ist. Diese Änderungen finden Sie in den Modulbeschreibungen angeführt. Die ursprüngliche Prüfungsform wird bei dieser Variante durchgestrichen, die neue Prüfungsform ist in oranger Schriftfarbe angegeben.
- **Alternative Prüfungsformen verankern und später darüber entscheiden**
Die Satzung sieht eine weitere Option vor. Es können zwei Alternativen festgelegt werden. Die Entscheidung für die eine oder die andere Alternative trifft der Modulverantwortliche und ist den Studierenden spätestens vier Wochen vor der Prüfung bekannt zu geben. Hier bleibt die ursprüngliche Prüfungsform zunächst bestehen, darunter finden Sie die alternative Prüfungsform eingefügt, ebenfalls in oranger Schriftfarbe. Vier Wochen vor der Prüfung wird die finale Prüfungsform durch den Modulverantwortlichen bekannt gegeben.

Im Informationssystem UnivIS finden Sie unter www.univis.fau.de demnächst für alle Veranstaltungen Angaben, in welchem Format (Online, Präsenz oder hybrid Online/Präsenz) die Lehrveranstaltungen abgehalten werden sowie Detailinformationen zum jeweiligen Online-Format bzw. Informationen zu Zeit und Ort.

Ausführlichere Informationen zu den Modulen finden Sie auch in den jeweiligen Kursen auf StudOn. Treten Sie daher unbedingt den Kursen bei, die Sie dieses Semester besuchen möchten.

Weitere aktuelle Informationen entnehmen Sie bitte den Webseiten der Lehrstühle sowie Informationen zum digitalen Semester an der WiSo auch unter www.wiso-virtuell.fau.de

Please note

Since the end of the pandemic is not yet forecastable, the faculty is adjusting the organization of lectures. This is why the concept WiSo-Virtuell, which was developed as an answer to the corona crisis, has now been expanded to the concept WiSo-Virtuell^{plus}.

By digitalizing all compulsory modules, we are able to guarantee that it remains possible to study all of our study programs. Additionally, a selection of lectures will contain on-site teaching elements next to digital contents, which can be attended on a voluntary basis. The electives will be structured in a way that, next to digital offers, parts of lectures or whole lectures can take place on campus.

Students may decide whether they would like to make use of the on-site offers or prefer to continue studying digitally depending on their needs and personal situation: digital/virtual studies PLUS selected voluntary on-site lectures. All on-site offers are of course subject to the current rate of new infections during the semester. Due to the restrictions in our teaching and examination activities caused by the corona virus SARS CoV-2, FAU has published a set of corona regulations. The module handbook in its present version contains changes in the examination method induced by corona, which are marked in the respective module description.

Based on the corona regulations, the following scenarios are possible:

- **Examination method unchanged**

The originally intended examination method, e.g., an exam, persists. There are no changes to this module.

- **One-time change of the examination method in the summer term**

Changes in the examination method are possible if the originally intended examination method is not realizable due to the corona virus. These changes can be found in the module description of the respective module. The original examination method is crossed out in this case, the new examination method is marked in orange font color.

- **Anchor alternative examination method and decide later**

The corona regulations allow for a third alternative. It is possible to set two alternative examination methods. The decision on one of the two alternatives is made by the respective responsible person for the module and must be communicated to the students at least four weeks before the examination takes place. In this case, the originally intended examination method remains in place and you will find the alternative examination method written below in orange font color. Four weeks before the examination, the final examination method will be announced by the responsible examiner.

Soon, you'll find detailed information on all lectures' format (online, on-site, or hybrid), as well as date, time, and place on the information system UnivIS, available at www.univis.fau.de.

More extensive information on the modules offered this term can also be found on StudOn. It is essential to join the courses you would like to attend on StudOn.

Further current information can be found on each department's websites, as well as the digital semester platform www.wiso-virtuell.fau.de.

Impressum

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Rechtsbelehrung

Alle Angaben sind ohne Gewähr.
Im Zweifelsfall gilt die Master-Prüfungsordnung.
Wenden Sie sich bei Fragen bitte direkt
an den zuständigen Modulverantwortlichen.

Stand: **29.03.2021**

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Abkürzungsverzeichnis

ECTS	European Credit Transfer System
EK	Einführungskurs
Co	Courses
h	Hours / Stunden
HS	Hauptseminar
Lect.	Lecture
MC-Test	Multiple-Choice-Test
min	Minutes
P	Presentation / Präsentation
ProS	Proseminar
S	Seminar
SS	Summer Term / Sommersemester
SWS	Time a module will be held per week. One SWS is 45 min / Semesterwochenstunden
Ü	Exercise / Übung
V	Lecture / Vorlesung
WS	Winter Term / Wintersemester

Hinweis zu Art und Umfang von Prüfungsleistungen

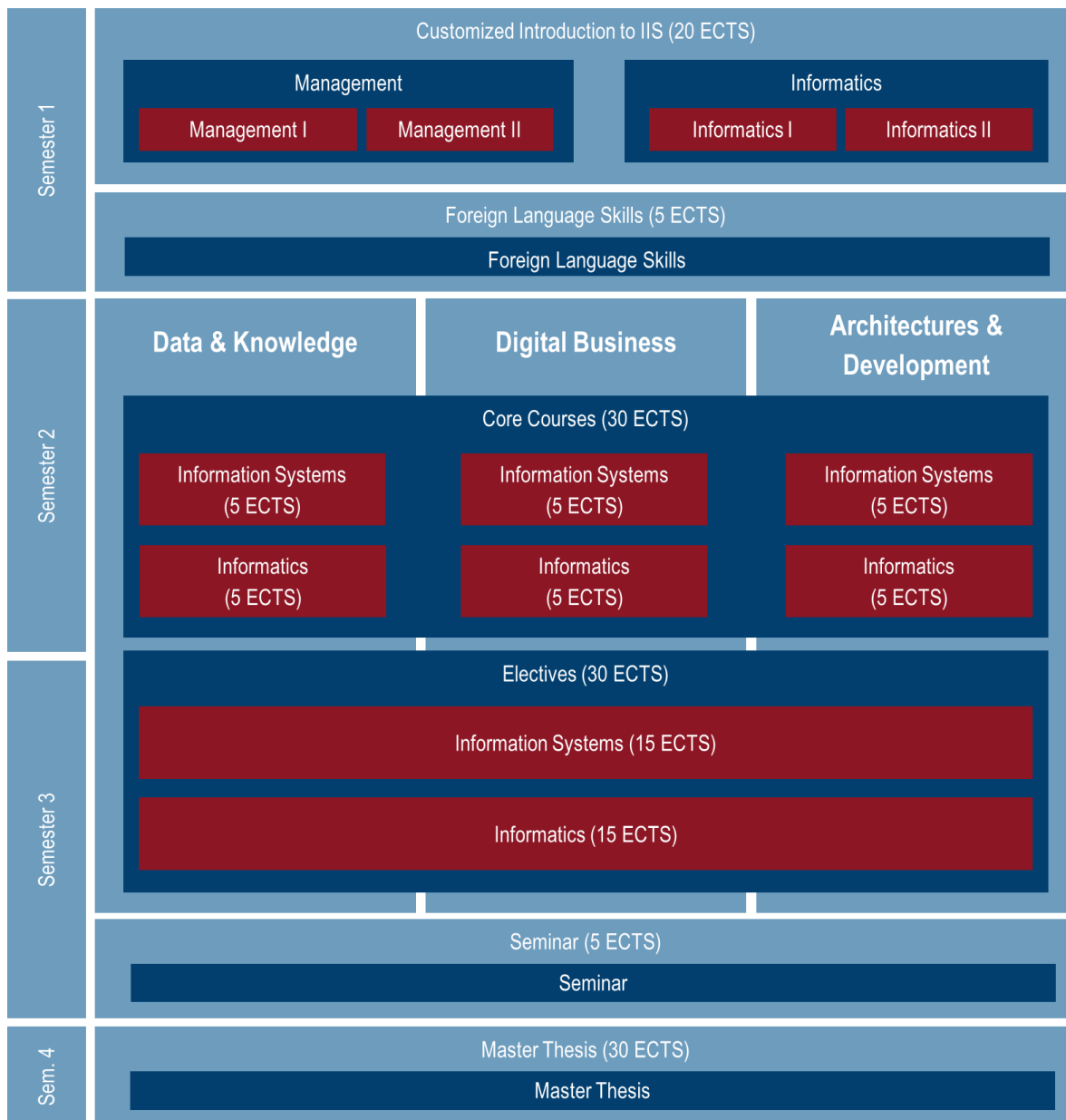
Die Art der am Fachbereich Wirtschaftswissenschaften gültigen Prüfungsleistungen ist definiert in §16 Prüfungsarten der Master-Rahmenprüfungsordnung (MPO). Darüber hinaus sind Prüfungsumfänge in den §§17, 18 MPO geregelt. Die Prüfungsordnungen sind unter folgendem Link einzusehen:

<http://www.zuv.fau.de/universitaet/organisation/recht/studiensatzungen/rw.shtml#Wirtschaft>

Soweit die einzelnen Modulbeschreibungen nichts Genaueres definieren, sind für die Masterstudiengänge am Fachbereich folgende Prüfungsformen mit den entsprechenden Prüfungsumfängen gültig:

Prüfungsart	Umfang Master
1. schriftliche Prüfung:	
a. Klausur	60/90/120 Minuten
b. Hausarbeit	ca. 15 Seiten
c. Seminararbeit	ca. 15 Seiten
2. mündliche Prüfung	
3. Sonderformen, insbesondere:	
a. Projektarbeit /-bericht	ca. 30 Seiten
b. Praktikumsbericht	ca. 4 Seiten
c. Thesenpapier	ca. 2 Seiten
d. Protokoll	ca. 6 Seiten
e. Kurztest	ca. 15 Minuten
f. Referat	ca. 25 Minuten
g. Präsentation/Präsentationspapier	ca. 20 Minuten/ca. 20 Seiten
h. Diskussionspapier	ca. 10 Seiten
i. Moderation	ca. 20 Minuten
j. Lehrprobe	ca. 45 Minuten
k. Fallstudie	ca. 25 Minuten und/oder 10 Seiten
l. Diskussionsbeitrag (ehemals: Diskussionsbeteiligung/Mitarbeit)	ca. 10 Minuten
m. Portfolioprüfung	k.A.
n. Elektronische Prüfung	ca. 90 Minuten
o. Antwort-Wahl-Verfahren	ca. 30 Minuten
p. Versuchspersonenstunde	ca. 60 Minuten
q. Reflexion	ca. 10 Minuten oder 10 Seiten
r. Strategiekonzept	ca. 6 Seiten

Modulübersicht



Master in International Information Systems			Semester			
			1	2	3	4
		ECTS	ECTS	ECTS	ECTS	ECTS
Customized Introduction to International Information Systems						
Management I und Management II <i>oder</i>	BWL+WI	20	20			
Informatics I und Informatics II	INF	20				
Foreign Language Skills						
Foreign Language Skills	NN	5	5			
Information Systems						
Core Courses (Kernbereich)*						
Modulbereich: Data & Knowledge	WI	5	5			
Modulbereich: Digital Business	WI	5		5		
Modulbereich: Architectures & Development	WI	5			5	
Modulbereich: Architectures & Development	WI	5				
Electives (Wahlpflichtbereich)**						
Modulbereich: Data & Knowledge	WI	0-15		0-15	0-15	
Modulbereich: Digital Business	WI	0-15		0-15	0-15	
Modulbereich: Architectures & Development	WI	0-15		0-15	0-15	
Modulbereich: Extension Courses	WI	0-15		0-15	0-15	
Modulbereich: Study Abroad Courses***	WI	0-15			0-15	
Informatics						
Core Courses (Kernbereich)*						
Modulbereich: Data & Knowledge	INF	5			5	
Modulbereich: Digital Business	INF	5		5		
Modulbereich: Architectures & Development	INF	5		5		
Electives (Wahlpflichtbereich)**						
Modulbereich: Data & Knowledge	INF	0-15		0-15	0-15	
Modulbereich: Digital Business	INF	0-15		0-15	0-15	
Modulbereich: Architectures & Development	INF	0-15		0-15	0-15	
Modulbereich: Extension Courses	INF	0-15		0-15	0-15	
Modulbereich: Study Abroad Courses***	INF	0-15			0-15	
Seminar						
Seminar International Information Systems	WI+INF	5			5	
Masterarbeit						
Master Thesis	WI+INF	30				30
			30	30	30	30

* Innerhalb des Kernbereichs müssen pro Modulbereich verpflichtend Module im Umfang von 5 ECTS-Punkten absolviert werden. (Ggf.) Auswahl von Modulen im Wert von 5 ECTS-Punkten gemäß Modulhandbuch. Module, die bereits im Rahmen des Bachelorstudiums oder anderer Modulbereiche des Curriculums absolviert wurden, können wegen des erforderlichen Kompetenzgewinns nicht noch einmal gewählt werden.

** Auswahl von Modulen im Umfang von 15 ECTS-Punkten gemäß Modulhandbuch. Module, die bereits im Rahmen des Bachelorstudiums oder anderer Modulbereiche des Curriculums absolviert wurden, können wegen des erforderlichen Kompetenzgewinns nicht noch einmal gewählt werden.

*** In Absprache mit dem Studiengangskoordinator (Learning Agreement) können inhaltlich zum Wahlpflichtbereich passende Veranstaltungen auf Master-Niveau im Umfang von bis zu max. 15 ECTS-Punkten an einer ausländischen Universität erworben werden.

Stand: 31.08.2018. Ohne Gewähr. Änderungen vorbehalten. Die aktuelle Übersicht ist Teil der Prüfungsordnung, die hier zu finden ist: www.wiso.fau.de/pruefungsordnung

Leitfaden zur Stundenplangestaltung

Studierende können sich ihren Stundenplan im elektronischen Vorlesungsverzeichnis *univis* selbst zusammenstellen. Hier sind alle Lehrveranstaltungen semesteraktuell nach bestimmten Themen oder einzelnen Lehrstühlen hinterlegt sowie die jeweiligen Dozierenden einsehbar. Über den Pfad <https://univis.fau.de/> >> *Vorlesungsverzeichnis* >> *Rechts- und Wirtschaftswissenschaftliche Fakultät (RW)* >> *Fachbereich Wirtschaftswissenschaften* gelangen Sie zu den Lehrveranstaltungen am Fachbereich Wirtschaftswissenschaften. An dieser Stelle ist es nun möglich, gezielt Bachelor- oder Masterveranstaltungen auszuwählen. Eine Hilfe zur Erstellung des Stundenplans ist hier zu finden: www.wiso.fau.de/stundenplan

**Please note:**

According to section 3 subsection 4 of the examination regulations of the study program M. Sc. International Information Systems as amended on 05.06.2014 students are required to spend at least one semester abroad. Students can go on an exchange semester to a foreign university, do their master's thesis in cooperation with a foreign university or with a company located outside of Germany.

**Bitte beachten Sie:**

Gemäß § 3 Abs. 4 der Fachprüfungsordnung des Masterstudiengangs International Information Systems in der Fassung vom 05.06.2014 müssen die Studierenden im Verlauf des Studiums mindestens ein Semester im Ausland verbringen. Hierfür kommt ein Studiensemester an einer ausländischen Hochschule, die Masterarbeit an einer ausländischen Hochschule oder die Ausarbeitung der Masterarbeit bei einem Unternehmen im Ausland in Betracht.

		Sem. 1 ECTS	Sem. 2 ECTS	Sem. 3 ECTS	Sem. 4 ECTS
	ECTS	ECTS	ECTS	ECTS	ECTS
Customized Introduction to International Information Systems					
Management or	20				
Management I	10				
Foundations of international management I		5			
Foundations of international management II		5			
Management II	10				
Business strategy		5			
Global retail logistics or		5			
Global operations strategy		5			
Informatics	20				
Informatics I	10				
Introduction to Computer Science		10			
Informatics II	10				
Konzeptionelle Modellierung		5			
Praktische Softwaretechnik or		5			
Software development in large projects		5			
Foreign Language Skills					
Foreign language skills	5				
Foreign language skills (I+II)		5			
International Information Systems Management					
Core Courses (Kernbereich)	15				
Modulbereich: Data & Knowledge (choose 1 out of 4 options)	5				
Business Intelligence (SS)					
Enterprise Knowledge Management (WS)					
Foundations of Linked Data (SS)					
Data Analytics for Information Systems (WS)					
Modulbereich: Digital Business (choose 1 out of 3 options)	5				
Advanced Service Management (SS)					
Digital Change Management (SS)					
Innovation and Leadership (WS)					
Modulbereich: Architectures & Development (choose 1 out of 4 options)	5				
Designing Technology (WS)					
Managing enterprise-wide IT Architectures (SS)					
Process Analytics (WS)					
User Experience in a Business Context (WS)					
Electives (Wahlpflichtbereich)	15				
Modulbereich: Data & Knowledge	0-15		0-15	0-15	
Business Intelligence (SS)					
Enterprise Knowledge Management (WS)					
Foundations of Linked Data (SS)					
Data Analytics for Information Systems (WS)					
Social and AWI Web Intelligence (WS)					
Platform strategies Strategies (WS)					
Deep Vision Systems					
Modulbereich: Digital Business	0-15		0-15	0-15	
Advanced Service Management (SS)					
Digital Change Management (SS)					
Innovation and Leadership (WS)					
Create your fintech startup (SS)					
Praxisseminar Innovative Versich. (SS, WS)					
Digital Transformation Pproject (SS)					
Organizing for Digital Transformation (SS)					
Managing Global Projects + MIT (WS)					
Service linnovation (SS)					
Patenting for Innovation (PFI) (WS)					
Electronic Human Resources Management (WS)					
Judgment in Decision Making and e.-b. Management (SS)					
Modulbereich: Architectures & Development	0-15		0-15	0-15	
Designing Technology (WS)					
Managing enterprise-wide IT Architectures (SS)					
Process Analytics (WS)					
User Experience in a Business Context (WS)					
Advanced Process Management (WS)					
Case Solving Seminar (WS, SS)					
Designing Gamified Systems					
Modulbereich: Extension Courses	0-15		0-15	0-15	
Deep Vision Systems					
Designing Gamified Systems					

Modulbereich: Study abroad courses	0-15	0-15		
	ECTS	Sem. 1 ECTS	Sem. 2 ECTS	Sem. 3 ECTS
				Sem. 4 ECTS
Informatics				
Core Courses (Kernbereich)	15			
Modulbereich: Data & Knowledge (choose 1 out of 4 options)	5			
Data Warehousing + Transaction Systems (LS Inf 6, SS)				
Informationsvisualisierung (LS Inf 9, WS)				
Introduction to pattern recognition (LS Inf 5, WS)				
NYT-VUE (OSR, WS)				
Modulbereich: Digital Business (choose 1 out of 2 options)	5			
COSS (WS)				
Human Computer Interaction (LS Inf 5, SS)				
Modulbereich: Architectures & Development (choose 1 out of 3 options)	5			
SWE-GL-Konstr + Ü (SS)				
POIS (SS)				
SPM (WS)				
Electives (Wahlpflichtbereich)	15			
Modulbereich: Data & Knowledge	0-15		0-15	0-15
Informationsvisualisierung (LS Inf 9, WS)				
NYT-VUE (OSR, WS)				
NYT-PROJ (OSR, WS)				
Middleware – Cloud computing (LS Inf 4, WS)				
Simulation and modeling I (LS Inf 7, WS)				
Simulation and modeling II (LS Inf 7, SS)				
Introduction to pattern recognition (LS Inf 5, WS)				
Pattern recognition (LS Inf 5, WS)				
Applied visualization (LS Inf 9, SS)				
Künstliche Intelligenz I (WS)				
Künstliche Intelligenz II (SS)				
Deep Learning (LS Inf 5, WS)				
Pattern Analysis (LS Inf 5, SS)				
Modulbereich: Digital Business	0-15		0-15	0-15
COSS-UE (WS)				
Human Computer Interaction (LS Inf 5, SS)				
AMOS-PO (SS)				
ES + DS (LS Inf 1, WS & SS)				
HumSecPri+ Ü (LS Inf 1, SS)				
Forensische Informatik (LS Inf 1, SS)				
Cryptocurrencies (SS)				
Foundations of Cryptocurrencies (SS)				
EinfITSec + Ü (LS Inf 1, WS)				
IT-Modernisierung (LS Inf 5, SS)				
Inno-Labor (SS, WS)				
Modulbereich: Architectures & Development	0-15		0-15	0-15
SWE-GL-Konstr + Ü (SS)				
POIS (SS)				
SPM (WS)				
Fehlertol. Softwarearchitekturen (WS)				
OSS_PROJ (SS)				
ARCH (SS)				
AMOS-SD (SS)				
TSWS (SS)				
OOAD (SS)				
ADAP (WS)				
SoSy3 + Ü (WS)				
SWE-ZUV (SS)				
SWE-GL + Design Patterns (SS)				
SWE-GL + SWE-PR (SS)				
SWE-PR + Design patterns (SS)				
SWE-VV + Ü (WS)				
SWE-PR + Krypto (WS)				
EBTEIS (WS)				
OSS-SEMI				
Modulbereich: Extension Courses	0-15		0-15	0-15
Verteilte Systeme (LS Inf 4, SS)				

Rechnerkommunikation (LS Inf 7, SS)
 Kommunikationssysteme (LS Inf 7, WS)
 Dienstgüte von Kommunikationssystemen (LS Inf 7, SS)
 Fahrzeugkommunikation (LS Inf 7, SS)
 Smart grids und Elektromobilität (LS Inf 7, SS)
 MOSES (LS Inf 7, WS)

Modulbereich: Study Abroad Courses	0-15	0-15			
Seminar International Information Systems					
Seminar International Information Systems (choose one out of four options)	5	5			
Interdisciplinary business seminar (SS, WS)					
Nailing your Thesis (NYT) (WS)					
Value co-creation seminar (SS)					
Research seminar on data management (SS, WS)					
Digitalization of work and life (SS)					
IoTSS (SS, WS)					
UX research (SS)					
Designing Information Systems for Behaviour Change (SS)					
Master Thesis					
Master Thesis	30	30			
	120	30	30	30	30

I Specializations / Schwerpunktbereiche

Please note:

Students starting from the **winter term 2016/17** can choose to study specialisations. Specializations are combinations of related modules in which a minimum of 20 ECTS are to be completed. If a module is allocated to more than one specialisation students may decide themselves which specialisation it is to be allocated to. Within a specialization, at least one module (5 ECTS) from the area Information Systems and one module (5 ECTS) from the area Informatics has to be chosen. Upon request, students may receive written confirmation of up to two specialisations that they have studied. The five available specialisations and their respective modules are the following:

Bitte beachten Sie:

Studierende mit Studieneintritt ab dem **Wintersemester 2016/17** können Schwerpunktbereiche studieren. Schwerpunktbereiche sind inhaltlich zusammenhängende Module, in denen mindestens 20 ECTS zu erwerben sind. Bei Zuordnung eines Moduls zu mehreren Schwerpunktbereichen können die Studierenden selbst festlegen, welchem Schwerpunktbereich ein Modul zugeordnet wird. In einem Schwerpunktbereich muss mindestens ein Modul (5 ECTS) aus dem Bereich Information Systems und mindestens ein Modul (5 ECTS) aus dem Bereich Informatics gewählt werden. Auf Antrag werden bis zu zwei Schwerpunktbereiche in einer Bescheinigung aufgeführt, wenn sie studiert wurden. Die fünf Schwerpunktbereiche und deren Module sind wie folgt aufgebaut:

Business Analytics

Veranstaltungen zur Verwaltung, Speicherung und Analyse von (Big) Data in Unternehmen, Ergebnisvisualisierung und Anwendungsszenarien.

Modul	Semester	Sprache	ECTS	Bereich
<u>Business Intelligence</u>	SS	Englisch	5	Information Systems
	SS	Deutsch und Englisch	5	Informatics
<u>Informationsvisualisierung</u>	WS	Deutsch	5	Informatics
<u>Applied visualization</u>	SS	Englisch	5	Informatics
<u>Introduction to pattern recognition</u>	WS	Englisch	5	Informatics
<u>Pattern recognition</u>	WS	Englisch	5	Informatics
<u>Pattern analysis</u>	SS	Englisch	5	Informatics
<u>Deep Learning</u>	SS + WS	Englisch	5	Informatics
<u>Social and web intelligence</u>	WS	Englisch	5	Information Systems
<u>Process analytics</u>	WS	Englisch	5	Information Systems
<u>Foundations of linked data</u>	SS	Englisch	5	Information Systems

Enterprise Architecture

Veranstaltungen zur Gestaltung von Strukturen im Unternehmen durch IT-Unterstützung (Softwarearchitekturen) sowie auf strategischer Ebene (Unternehmensarchitekturen)

Modul	Semester	Sprache	ECTS	Bereich
<u>Advanced process management</u>	WS	Englisch	5	Information Systems
<u>Fundamentals of enterprise-wide IT architecture management</u>	SS	Englisch	5	Information Systems
<u>Designing technology</u>	WS	Englisch	5	Information Systems
<u>Process-oriented information systems</u>	SS	Englisch	5	Informatics
<u>E-Business Technologies + Evolutionäre Informationssysteme</u>	WS	Deutsch	5	Informatics
<u>Software architecture</u>	SS	Deutsch	5	Informatics
<u>Fehlertolerante Softwarearchitekturen</u>	WS	Deutsch oder Englisch	5	Informatics

Networked Business

Veranstaltungen zur Organisation und Verwaltung technischer Netzwerke im Unternehmen sowie der strategischen Vernetzung mit Kunden und Partnern

Modul	Semester	Sprache	ECTS	Bereich
<u>Advanced service management</u>	SS	Englisch	5	Information Systems
<u>Platform strategies</u>	WS	Englisch	5	Information Systems
<u>Managing global projects + managing information technologies</u>	WS	Englisch	5	Information Systems

<u>Verteilte Systeme</u>	SS	Deutsch	5	Informatics
<u>Rechnerkommunikation</u>	SS	Deutsch	5	Informatics
<u>Kommunikationssysteme</u>	WS	Deutsch	5	Informatics
<u>Dienstgüte von Kommunikationssystemen</u>	SS	Deutsch	5	Informatics
<u>Free, Libre and Open-Source software</u>	SS	Englisch	5	Informatics

Digital Transformation

Veranstaltungen zur Organisation und kontinuierlichen Entwicklung neuer Geschäftsmodelle und Informationstechnologien

Modul	Semester	Sprache	ECTS	Bereich
<u>Organizing for digital transformation</u>	SS	Englisch	5	Information Systems
<u>Innovation and leadership</u>	WS	Englisch	5	Information Systems
<u>Managing global projects + Managing information technologies</u>	WS	Englisch	5	Information Systems
<u>Praxisseminar: Innovative Versicherungsprodukte</u>	WS und SS	Deutsch	5	Information Systems
<u>Digital change management</u>	SS	Englisch	5	Information Systems
<u>E-Business Technologies + Evolutionäre Informationssysteme</u>	WS	Deutsch	5	Informatics
<u>Human computer interaction</u>	SS	Deutsch	5	Informatics
<u>IT-Modernisierung</u>	SS	Deutsch	5	Informatics
<u>Free, Libre and Open-Source software</u>	SS	Englisch	5	Informatics

Software Product Management

Veranstaltungen zur Organisation und Durchführung interner Marktanalysen sowie externer Vermarktungsstrategien in der Software-Produktentwicklung.

Modul	Semester	Sprache	ECTS	Bereich
<u>Software project management</u>	WS	Deutsch	5	Informatics
<u>Commercial Open Source Startups / Product Management</u>	WS	Englisch	5	Informatics
<u>Praktische Softwaretechnik</u>	WS	Deutsch oder Englisch	5	Informatics
<u>The AMOS project</u>	SS	Englisch	5/10	Informatics

II Customized Introduction (20 ECTS)



Depending on their previous field of study, students take **one** of these two options. The option will be assigned and cannot be chosen by the student.

- Students with a background in computer science and students with a background in business information systems must take the **„Management“** option.
- Students with management background are required to study **„Informatics“**.



Je nach Vorbildung belegen die Studierenden eine der zwei folgenden Optionen. Die Option wird den Studierenden zugeteilt und ist nicht frei wählbar.

- Studierende mit Grundkenntnissen in Wirtschaftsinformatik oder Informatik belegen die Module im **„Management“** Bereich.
- Studierende, die BWL Grundkenntnisse haben, belegen die Option **„Informatics“**.



Management Introduction (20 ECTS)

Management I (10 ECTS)

Foundations of international management I (FIM I)

1	Module name MIBS-53710	Foundations of international management I	5 ECTS
2	Courses/lectures IIS37101 IIS37102	Lect 1/S 1: Foundations of international management I (3 SWS)	5 ECTS
3	Lecturers	Prof. Holtbrügge and assistants	

4	Module coordinator	Prof. Holtbrügge
5	Contents	1. Environment of International Management: History and Major Trends 2. Theoretical and Conceptual Foundations of International Management 3. Theories of Internationalization 4. Strategic management in International Corporations
6	Learning objectives and skills	The participants understand and analyze typical management problems of international firms. The participants will get to know modern theories and methods of international management and will be able to apply these to practical problems. They get a detailed overview of the current state of international management research and are able to evaluate theoretical and empirical studies in this area critically.
7	Recommended prerequisites	English language proficiency (C1)
8	Integration in curriculum	First semester
9	Module compatibility	Master in International Information Systems: Module in the section Customized Introduction to IIS (Management) (ab 2016/17 + 2018/19) Master IBS: core course (Pflichtbereich) Master Marketing: Wahlpflichtbereich der Modulgruppe „Management“ Master Sozialökonomik: freier Vertiefungsbereich sowie im Pflichtbereich „Spezielle BWL“ Master Arbeitsmarkt und Personal: Wahlbereich Master Economics: Wahlbereich Master Management: Vertiefungsbereich
10	Method of examination	Discussion paper and Presentation
11	Grading procedure	Discussion paper (80%) and Presentation (20%)
12	Module frequency	Each winter term
13	Workload	Contact hours: 45 h Independent study: 105 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	Holtbrügge, D. & Welge, M.K. (2020). International Management. Mimeo, Nürnberg (chapters 1-4). Holtbrügge, D. & Haussmann, H. (eds.) (2017). Internationalization Strategies of Firms. Case Studies from the Nürnberg Metropolitan Region. 2 nd edition. Augsburg-München: Hampp.

1	Module name MIBS-53720	Foundations of international management II	5 ECTS
2	Courses/lectures	Lect/S: Foundations of international management II (3 SWS)	5 ECTS
3	Lecturers	Prof. Holtbrügge and assistants	
4	Module coordinator	Prof. Holtbrügge	
5	Contents	Foundations of International Management II: 1. Organization of International Corporations 2. Human Resources Management in International Corporations 3. Public Affairs Management in International Corporations	
6	Learning objectives and skills	The participants understand and analyze typical management problems of international firms. The participants will get to know modern theories and methods of international management and will be able to apply these to practical problems. They get a detailed overview of the current state of international management research and are able to evaluate theoretical and empirical studies in this area critically.	
7	Recommended prerequisites	Successful attendance of Foundations of International Management I English language proficiency (C1)	
8	Integration in curriculum	First semester	
9	Module compatibility	Master in International Information Systems: Module in the section Customized Introduction to IIS (Management) (ab 2016/17 + 2018/19) Master IBS: core course (Pflichtbereich) Master Management: Vertiefungsbereich Master Marketing: Wahlpflichtbereich der Modulgruppe „Management“ Master Sozialökonomik: freier Vertiefungsbereich oder im Pflichtbereich „Spezielle BWL“ Master Arbeitsmarkt und Personal: Wahlbereich Master Economics: Wahlbereich	
10	Method of examination	Discussion paper and Presentation	
11	Grading procedure	Discussion paper (80%) and Presentation (20%)	
12	Module frequency	Each winter term	
13	Workload	Contact hours: 45 h Independent study: 105 h	
14	Module duration	1 semester	
15	Teaching and examination language	English	
16	(Recommended) reading	Holtbrügge, D. & Welge, M.K. (2020): International Management. Mimeo, Nürnberg (chapters 5, 6 & 8). Holtbrügge, D. & Haussmann, H. (eds.) (2017). Internationalization Strategies of Firms. Case Studies from the Nürnberg Metropolitan Region. 2 nd edition. Augsburg-München: Hampp.	

Management II (10 ECTS)



The module "Management II" comprises two parts:

- **Part 1:** The course "Business strategy" is mandatory.
- **Part 2:** Students have to take either "Global retail logistics" (Option 1) or "Global operations strategy" (Option 2).



Das Modul "Management II" besteht aus zwei Teilen:

- **Teil 1:** Die Lehrveranstaltung „Business strategy“ ist verpflichtend.
- **Teil 2:** Die Studierenden belegen entweder die die Vorlesung „Global retail logistics“ (Option 1) oder "Global operations strategy" (Option 2).

Business strategy

1	Module name MIM-53410	Business strategy	5 ECTS
2	Courses/lectures	L/P: Business strategy (3 SWS)	5 ECTS
3	Lecturers	Prof. Junge and assistants	

4	Module coordinator	Prof. Junge / Prof. Hungenberg
5	Contents	This course focuses on selected theories, concepts and tools of strategic management. It is concerned with formulation and implementation of strategies, focusing on the business level of strategy. At business level, customer value and competitive advantage are the central issues. In this context, the digital transformation triggers digital business models, such as platform strategies or other related disruptive innovations. Therefore, the digital transformation is a central focus of this course. The course uses a combination of lectures, discussions and case studies in order to provide the analytic and conceptual foundations for making strategic decisions at business level.
6	Learning objectives and skills	By the end of the course, students can appreciate the need for a comprehensive approach to strategy making and they are aware of top management's role in setting the direction of a company. Students develop knowledge of theories, concepts and tools of business strategy and they develop an understanding of the application of concepts and tools to real life cases.
7	Recommended prerequisites	None
8	Integration in curriculum	First semester
9	Module compatibility	Master IBS: core course (Pflichtbereich) Master in International Information Systems (ab 2018/19): Module in the section Customized Introduction to IIS (Management II) Master Management: Pflichtbereich I Master Wirtschaftspädagogik, Studienrichtung I: fachwissenschaftlicher Pflichtbereich; Studienrichtung II: fachwissenschaftlicher Wahlbereich Master International Production Engineering and Management: Interdisziplinäre IEM Master Wirtschaftsingenieurwesen: Wahlbereich
10	Method of examination	Written examination (60 min.)

11	Grading procedure	Written examination result (100%)
12	Module frequency	Winter term
13	Workload	Attendance: 45 h Self-study: 105 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	Hungenberg, H.: Strategisches Management in Unternehmen, 8. Ed., Wiesbaden 2014 Dess, G., McNamara, G., Eisner, A.: Strategic management, 8. Ed., Maidenhead 2016

Global operations strategy

1	Module name MIM-53650	Global operations strategy	5 ECTS
2	Courses/lectures	S: Global operations strategy (2 SWS)	5 ECTS
3	Lecturers	Prof. Voigt and research assistants	

4	Module coordinator	Prof. Voigt
5	Contents	During the past decades, operations have become increasingly international or even global in nature. Drivers of the globalization include increased competitiveness through offshore manufacturing and global sourcing. During this module, the increasing complexity and the challenges of operations on a global scale will be discussed together with the participants. The theory modules at the beginning structure the options of a general operations strategy and illustrate its implementation in the organization. The subject specific modules, elaborated by the participants, enable a profound understanding of single activity areas of global operations and their relation to the global operations strategy. Therewith the students will get insights in the importance of an integrated global operations strategy and will become familiar with the main strategic options in this field.
6	Learning objectives and skills	Participation in the first seminar session is mandatory, as the topics for the teamwork are chosen during this session by the participants. In the following weeks, based on own research using scientific sources, key topics are elaborated in teams. Following predefined learning targets, the students need to structure the elaborated content in an academic presentation and present their results in class. Thereby, the teams are responsible for developing a didactic concept in order to support the understanding of the discussed topics. Furthermore, the participants are required to document their research method as well as their results. After the course, the participants are able to discuss the functions and impact of operations management in an international context.
7	Recommended prerequisites	None
8	Integration in curriculum	First semester
9	Module compatibility	Master IBS: core course (Pflichtbereich) Master Management: Vertiefungsbereich Master Marketing: Wahlpflichtbereich der Modulgruppe „Management“ Master Sozialökonomik: freier Vertiefungsbereich oder im Pflichtbereich „Spezielle BWL“ Master Arbeitsmarkt und Personal: Wahlbereich Master Economics: Wahlbereich Master in International Information Systems (ab 2018/19): Module in the section Customized Introduction to IIS (Management II)
10	Method of examination	Written examination 60 min. (Klausur, 60 Min.); Presentation (group presentation) (around three to five minutes per participant)
11	Grading procedure	Written examination (50%), Presentation (50%)

12	Module frequency	Winter Term (WS) All participants have to register in advance on StudOn! The registration for GOS on StudOn starts mid-September. The number of participants is limited to 60.
13	Workload	Attendance: 30 h Self-study: 120 h
14	Module duration	1 term
15	Teaching and examination language	English
16	(Recommended) reading	Abele, E. et al. (2008): Global Production. A Handbook for Strategy and Implementation. Berlin: Springer. Reid, R. D. & Sanders N. R. (newest ed.): Operations Management. Hoboken: Wiley & Sons. Slack, N. & Lewis, M. (newest ed.): Operations Strategy. Harlow: Prentice-Hall.

Global retail logistics

1	Module name MIM-55291	Global retail logistics	5 ECTS
2	Courses/lectures	L/E: Global retail logistics (4 SWS)	5 ECTS
3	Lecturers	Prof. Hartmann and assistants	

4	Module coordinator	Prof. Hartmann
5	Contents	This e-learning course offers specific insights on the logistic processes in the global retail industry. Upon completion of the course, the students should understand the peculiarities of logistics for fast moving consumer goods. Every module consists of an interactive lecture and script. Additional material and exercises enhance the presented topics further. As the entire lecture, the readings, the additional material and the exam is in English, proficiency in German is not necessary. The course is supposed to provide the students with the following content concerning the global retail industry: • Module 1: Overview of global retail logistics • Module 2: Characteristics & Basics • Module 3: Trends & Challenges • Module 4: PoS Logistics • Module 5: Interfaces • Module 6: Load units & transport logistics • Module 7: Cross docking • Module 8: Warehousing & distribution • Module 9: Food Supply Chain • Module 10: Sustainability in the Supply Chain
6	Learning objectives and skills	The following learning objectives are anticipated: You will be able to define the topic of retail logistics and describe its specific requirements. You will be able to report the retail industry specific peculiarities relating to the usage of logistics processes. You will be able to use the relevant methods of planning, controlling and monitoring of logistics processes in the retail industry. You will be able to analyse various retail-specific characteristics in the use of logistics processes and assess their application in a practical context. You will be able to apply the most important principles of global retail logistics, to manage logistic processes while solving the questions of supply, distribution, transport and storage of goods. You will be able to work creatively, generate new ideas, and solve problems regarding retail logistics in an international context, international interaction and cooperation, while accepting social and ethical responsibility. You will be able to manage, organise and discipline yourself, and plan your time independently.

		You will be able to demonstrate the ability to engage in critical thinking by analysing complex situations thus concluding and selecting viable solutions to solve problems.
7	Recommended prerequisites	English language proficiency (C1) Produktions- und Supply Chain Management Registration via vhb (www.vhb.org) is necessary in order to gain access to the StudOn e-learning platform.
8	Integration in curriculum	First semester
9	Module compatibility	Master in International Information Systems (ab 2018/19): Module in the section Customized Introduction to IIS (Management II) Master Management: Vertiefungsbereich Master Economics: Wahlbereich Master Wirtschaftsingenieurwesen: Wahlpflichtbereich
10	Method of examination	Written examination (60 min., partly with single choice)
11	Grading procedure	Written examination (100%)
12	Module frequency	Every semester
13	Workload	Presence hours: 1 h Self-study: 149 h
14	Module duration	1 Semester
15	Teaching and examination language	English
16	(Recommended) reading	Will be announced during the course



Informatics introduction (20 ECTS)

Informatics I (10 ECTS)

1	Module name IIS57019	Informatics I	10 ECTS
2	Courses/lectures	L: Introduction to Computer Science (4 SWS) E: Problem set exercises (2 SWS)	5 ECTS 5 ECTS
3	Lecturers	Prof. Andreas Harth, Prof. Martin Matzner and assistants	
4	Module coordinator	Prof. Martin Matzner	
5	Contents	• Concepts like: abstraction & encapsulation • Foundations of programming • Programming in languages C and Python • Web programming with HTML, CSS, SQL and JavaScript • Basics of algorithms & data structures	
6	Learning objectives and skills	The students understand... ... the foundations of programming ... the functional principle of programs ... to abstract and solve problems algorithmically ... the basics of web programming	
7	Recommended prerequisites	None	
8	Integration in curriculum	First semester	
9	Module compatibility	Master in International Information Systems: Module in the section Customized Introduction to IIS (Informatics)	
10	Method of examination	120-minute written examination (Klausur (120 min))	
11	Grading procedure	100% of module score (Lect.: 100 % der Modulnote)	
12	Module frequency	Each WS	
13	Workload	Contact hours: 60 h Independent study: 240 h	
14	Module duration	1 semester	
15	Teaching and examination language	English	
16	(Recommended) reading	Perry G., Miller D: C Programming Absolute Beginner's Guide, 3. Ed, 2014 White, R.: How Computers Work, 10. Ed., 2014 Kochan S.G.: Programming in C, 4 Ed.	

Informatics II (10 ECTS)



The module "Informatics II" comprises two parts:

- **Part 1:** The course "Konzeptionelle Modellierung" (lecture and exercise) is mandatory.
- **Part 2:** Students have to take either "Praktische Softwaretechnik" (Option 1) or "Software Development in Large Projects" (Option 2).



Das Modul „Informatics II“ besteht aus zwei Teilen:

- **Teil 1:** Die Lehrveranstaltung „Konzeptionelle Modellierung“ (Vorlesung und Übung) ist verpflichtend.
- **Teil 2:** Die Studierenden belegen entweder die die Vorlesung „Praktische Softwaretechnik“ (Option 1) oder "Software Development in Large Projects" (Option 2).

Informatics II part 1

1	Modulbezeichnung IIS57026	Informatics II (Teil 1)	5 ECTS
2	Lehrveranstaltungen IIS31301	V: Konzeptionelle Modellierung (2 SWS) Ü: Konzeptionelle Modellierung (2 SWS)	2,5 ECTS 2,5 ECTS
3	Lehrende	Prof. Lenz	

4	Modulverantwortliche/r	Prof. Lenz
5	Inhalt	Die Vorlesung behandelt die folgenden Themen: 1. Grundlagen der Modellierung 2. Datenmodellierung am Beispiel Entity-Relationship-Modell 3. Modellierung objektorientierter Systeme am Beispiel UML 4. Relationale Datenmodellierung und Anfragemöglichkeiten 5. Grundlagen der Metamodellierung 6. XML 7. Multidimensionale Datenmodellierung 8. Domänenmodellierung und Ontologien
6	Lernziele und Kompetenzen	Die Studierenden: • definieren grundlegende Begriffe aus der Datenbankfachliteratur • erklären die Vorteile von Datenbanksystemen • erklären die verschiedenen Phasen des Datenbankentwurfs • benutzen das Entity-Relationship Modell und das erweiterte Entity-Relationship Modell zur semantischen Datenmodellierung • unterscheiden verschiedene Notationen für ER-Diagramme • erläutern die grundlegenden Konzepte des relationalen Datenmodells • bilden ein gegebenes EER-Diagramm auf ein relationales Datenbankschema ab • erklären die Normalformen 1NF, 2NF, 3NF, BCNF und 4NF • definieren die Operationen der Relationenalgebra • erstellen Datenbanktabellen mit Hilfe von SQL • lösen Aufgaben zur Datenselektion und Datenmanipulation mit Hilfe von SQL • erklären die grundlegenden Konzepte der XML • erstellen DTDs für XML-Dokumente • benutzen XPATH zur Formulierung von Anfragen an XML-Dokumente • definieren die grundlegenden Strukturelemente und Operatoren des multidimensionalen Datenmodells • erklären Star- und Snowflake-Schema

		• benutzen einfache UML Use-Case Diagramme • benutzen einfache UML-Aktivitätsdiagramme • erstellen UML-Sequenzdiagramme • erstellen einfache UML-Klassendiagramme • erklären den Begriff Meta-Modellierung • definieren den Begriff der Ontologie in der Informatik • definieren die Begriffe RDF und OWL
7	Empfohlene Voraussetzungen für die Teilnahme	Gewünscht "Algorithmen und Datenstrukturen" und "Grundlagen der Logik und Logikprogrammierung"
8	Einpassung in Musterstudienplan	1. Semester
9	Verwendbarkeit des Moduls	Bachelor Wirtschaftsinformatik Bachelor Informatik Bachelor IuK Master International Information Systems: Teilmodul zu Informatics im Bereich Customized Introduction to IIS (ab 2016/17 + 2018/19)
10	Studien- und Prüfungsleistungen	Klausur (tw. mit MC Aufgaben) 90 Minuten
11	Berechnung Modulnote	100% der Klausurnote
12	Turnus des Angebots	Jedes Wintersemester
13	Arbeitsaufwand	Präsenzzeit: 60 h Eigenstudium: 90 h
14	Dauer des Moduls	1 Semester
15	Unterrichts- und Prüfungssprache	Deutsch
16	(Vorbereitende) Literatur	Alfons Kemper, Andre Eickler: <i>Datenbanksysteme : Eine Einführung</i>. 6., aktualis. u. erw. Aufl. Oldenbourg, März 2006. - ISBN-10: 3486576909 (Kapitel 2 bis 4 und Abschnitt 17.2) Bernd Oestereich: <i>Analyse und Design mit UML 2.1</i>. 8. Aufl. Oldenbourg, Januar 2006. - ISBN-10: 3486579266 Ian Sommerville: <i>Software Engineering</i>. 8., aktualis. Aufl. Pearson Studium, Mai 2007. - ISBN-10: 3827372577 Horst A. Neumann: <i>Objektorientierte Softwareentwicklung mit der Unified Modeling Language. (UML)</i>. Hanser Fachbuch, März 2002. - ISBN-10: 3446188797 Rainer Eckstein, Silke Eckstein: <i>XML und Datenmodellierung</i>. Dpunkt Verlag, November 2003. - ISBN-10: 3898642224

Informatics II part 2 (Option 1)

1	Modulbezeichnung IIS57027	Informatics II (Teil 2: Option 1)	5 ECTS
2	Lehrveranstaltungen IIS70241	V: PSWT (Praktische Softwaretechnik - 4 SWS)	5 ECTS
3	Lehrende	Prof. Hindel, Dr.-Ing. Jung, Prof. Kips, Dr.-Ing. Oster, Prof. Riehle	

4	Modulverantwortliche/r	Prof. Dr. Riehle
5	Inhalt	Software ist überall und Software ist komplex. Nicht triviale Software wird von Teams entwickelt. Oft müssen bei der Entwicklung von Softwaresystemen eine Vielzahl von funktionalen und nicht funktionalen Anforderungen berücksichtigt werden. Hierfür ist eine disziplinierte und ingenieurmäßige Vorgehensweise notwendig. Die Vorlesung „Praktische Softwaretechnik“ soll ... • ein Bewusstsein für die typischen Problemstellungen schaffen, die bei der Durchführung umfangreicher Softwareentwicklungsprojekte auftreten, • ein breites Basiswissen über die Konzepte, Methoden, Notationen und Werkzeuge der modernen Softwaretechnik vermitteln und • die Möglichkeiten und Grenzen ihres Einsatzes im Kontext realistischer Projektumgebungen anhand praktischer Beispiele demonstrieren und bewerten. Die Vorlesung adressiert inhaltlich alle wesentlichen Bereiche der Softwaretechnik. Vorgestellt werden unter anderem • traditionelle sowie agile Methoden der Softwareentwicklung, • Methoden der Anforderungsanalyse und des Systementwurfs, • Konzepte der Softwarearchitektur, -implementierung und Dokumentation und • Testen und Qualitätssicherung sowie Prozessverbesserung. Weitere Materialien und Informationen sind hier zu finden: • Zeitplan: http://goo.gl/0fy1T • Materialien: Auf StudOn über den Zeitplan • Die Teilnahme ist begrenzt. Bitte registrieren Sie sich zeitig für den Kurs auf StudOn, um sicherzustellen, dass Sie einen Platz erhalten.
6	Lernziele und Kompetenzen	Die Studierenden • verstehen den Unterschied zwischen „Programmieren im Kleinen“ und „Programmieren im Großen“ (Softwaretechnik) zu verstehen • wenden grundlegende Methoden der Softwaretechnik über den gesamten Projekt- und Produktlebenszyklus zu verstehen und anwenden zu können • kennen die Rolle und Zuständigkeiten der Berufsbilder „Projektleiter“, „Anforderungsermittler“, „Softwareentwickler“ und „Qualitätssicherer“ zu verstehen.
7	Empfohlene Voraussetzungen für die Teilnahme	Keine
8	Einpassung in Musterstudienplan	Informatik-Bachelor und Wirtschaftsinformatik-Bachelor: Während oder nach dem 4ten Semester

		Informatik-Master: Jederzeit Master International Information Systems: 1. Semester PSWT-PSWT steht weiteren Studiengängen offen, je nach Studienplan und –ordnung
9	Verwendbarkeit des Moduls	5 ECTS Vorlesung, je nach Studiengang als Pflicht oder Wahlpflichtveranstaltung Master International Information Systems: Teilmodul zu Informatics im Bereich Customized Introduction to IIS (ab 2016/17 + 2018/19)
10	Studien- und Prüfungsleistungen	90min. Klausur
11	Berechnung Modulnote	100% Klausurnote
12	Turnus des Angebots	Alle zwei Semester
13	Arbeitsaufwand	60h (4 SWS) Unterricht 90h Hausaufgaben sowie Vor- und Nachbereitung
14	Dauer des Moduls	1 Semester
15	Unterrichts- und Prüfungssprache	Deutsch oder Englisch
16	(Vorbereitende) Literatur	http://goo.gl/JSoUbV

Informatics II part 2 (Option 2)

4	Module name IIS57028	Informatics II (Teil 2: Option 2)	5 ECTS
5	Courses/lectures IIS31601	Software development in large projects (SoSy3) (lectures + exercises, 4 SWS)	5 ECTS
6	Lecturers	Prof. Saglietti	
4	Module coordinator	Prof. Saglietti	
5	Contents	• Introduction to the single phases of software development: requirements analysis, specification, design, implementation, test, maintenance • Exemplifying application of selected, representative techniques supporting the developments phases mentioned above • Ergonomic principles for usage interfaces • Object-oriented analysis and design with UML • Design patterns as constructive, re-usable solutions to whole classes of problems • Automatic support for code implementation from UML diagrams • Testing strategies • Re-factoring techniques supporting the maintenance phase	
6	Learning objectives and skills	On the basis of programming skills already acquired the students will • learn systematic and structured approaches to deal with the complexity of "developing in the large", • gain the capability of expressing complex problems in a well-defined way by means of appropriate specification languages, of analyzing such problems, as well as of deriving appropriate designs for their solution, • get experience in the application of UML diagrams for the purpose of object-oriented analysis and design activities, • get proficiency in re-using general design solutions by specialization of established design patterns, • get acquainted with principles of the testing process, • get familiar with re-factoring strategies aimed at increasing systematically software modifiability.	
7	Recommended prerequisites	None	
8	Integration in curriculum	First semester	
9	Module compatibility	Master in International Information Systems: Module in the section Customized Introduction to IIS (Informatics) (ab 2016/17 + 2018/19)	
10	Method of examination	90-minute written examination (Klausur (90 min))	
11	Grading procedure	Lect.: 100% of module score (Lect.: 100 % der Modulnote)	
12	Module frequency	Each WS	
13	Workload	Contact hours: 60 h Independent study: 90 h	
14	Module duration	1 semester	
15	Teaching and examination language	German or English	
16	(Recommended) reading	Lehrbuch der Softwaretechnik (Band 1), Helmut Balzert, 2000	

 As part of the curriculum “Foreign language skills” is a mandatory module.

 Das Modul „Foreign language skills” ist eine Pflichtveranstaltung.

Foreign language skills

1	Modulbezeichnung IIS57090	Foreign language skills	5 ECTS
2	Lehrveranstaltungen	Allgemeinsprachliche Grundausbildung 1 Übung im Umfang von 5 ECTS in einer Fremdsprache (mit Ausnahme von Englisch und Deutsch als Fremdsprache) aus dem Bereich UNlcert I oder II, d.h. aus dem Niveaubereich A1 bis B2 GER <u>oder</u> 1 Übung im Umfang von 5 ECTS in Deutsch als Fremdsprache ab dem Niveaubereich B1 <u>oder</u> Fachsprachliche Grundausbildung 1 Übung im Umfang von 5 ECTS oder 2 Übungen im Umfang von 2,5 ECTS in einer Fremdsprache aus dem Bereich UNlcert III Fachsprache. Die Kurse enden auf dem Niveau C1 GER	1 x 5 ECTS <u>oder</u> 1x 5 ECTS <u>oder</u> 1x 5 ECTS <u>oder</u> 2x 2,5 ECTS
3	Lehrende	Mitarbeiter der Abteilung Fremdsprachenausbildung Nürnberg des Sprachenzentrums der FAU (Leitung: Dr. Oesterreicher)	

4	Modulverantwortliche/r	Dr. Oesterreicher
5	Inhalt	Allgemeinsprachliche Grundausbildung: • Vermittlung und Vertiefung grundlegender schriftlicher und mündlicher Kompetenzen • Einführung in Präsentations- und kommunikativen Kompetenzen unter Berücksichtigung interkultureller Spezifika • Auf- und Ausbau einer fremdsprachlichen Hilfsmittelkompetenz Fachsprachliche Grundausbildung: • Vermittlung und Vertiefung handlungsorientierter schriftlicher und mündlicher Kompetenzen mit fachsprachlichem Bezug • Vermittlung von Präsentations- und kommunikativen Kompetenzen unter Berücksichtigung interkultureller Spezifika • Förderung der Studierfähigkeit • Auf- und Ausbau einer fremdsprachlichen Hilfsmittelkompetenz
6	Lernziele und Kompetenzen	Allgemeinsprachliche Grundausbildung: Die Studierenden erwerben die nötigen Grundkenntnisse der jeweiligen Fremdsprache. Sie werden an eine schriftlich und mündlich idiomatische Ausdrucksweise herangeführt. Sie erhalten einen Einblick in die interkulturellen und sprachimmanenten Spezifika der entsprechenden Kommunikationsformen. Sie können den Erwerb von in vorausgegangenen Modulen begonnenen Sprachen fortsetzen. Fachsprachliche Grundausbildung: Die Studierenden lernen schriftlichen und mündlichen Diskursen sowohl im Studium als auch arbeitsplatzbezogen zu folgen. Sie lernen sich idiomatisch adäquat schriftlich und mündlich auszudrücken. Sie erreichen eine Vertrautheit mit den interkulturellen und sprachimmanenten Spezifika der entsprechenden Kommunikationsformen. Sie können an in vorhergehenden Modulen erworbene Kenntnisse anknüpfen.
7	Empfohlene Voraussetzungen für die Teilnahme	Abschluss der dem Sprachkurs jeweils vorangehenden Niveaustufe des GER – nachweisbar über einen Einstufungstest, entsprechende Zertifikate oder erfolgreich abgeschlossene Kurse

8	Einpassung in Musterstudienplan	Ab 1. Semester
9	Verwendbarkeit des Moduls	Master International Information Systems; (ab 2016/17 + 2018/19) Master in Arbeitsmarkt & Personal (Wahlbereich); Master in Sozialökonomik (Wahlbereich) Master in Economics (Wahlbereich)
10	Studien- und Prüfungsleistungen	Je Übung eine 60 minütige Abschlussklausur + mündliche Leistung
11	Berechnung Modulnote	Ü = 100%
12	Turnus des Angebots	Jährlich im WS und SS
13	Arbeitsaufwand	Präsenzstudium: 60 h Eigenstudium: 90 h
14	Dauer des Moduls	1-2 Semester
15	Unterrichts- und Prüfungssprache	Je nach gewählter Fremdsprache
16	(Vorbereitende) Literatur	Lt. Auskunft Dozent

IV Information Systems

🇬🇧 The Information Systems part is made up of “Core Courses” and “Electives” worth 15 ECTS each. Students have to earn 5 ECTS in the Core Courses of each of the subject areas “Data & Knowledge”, “Digital Business” and “Architectures & Development”. Within the electives students can freely combine different modules of these subject areas. Some modules are included in the core courses as well as in the electives. These modules can only be taken once, as either a core or an elective course.

The graph below shows the available options for the Core Courses and Electives.

🇩🇪 Der Bereich Information Systems besteht aus „Core Courses“ (Kernbereich) und „Electives“ (Wahlbereich) mit jeweils 15 ECTS. Die Studierenden müssen jeweils 5 ECTS aus den Kernbereichen der “Data & Knowledge”, “Digital Business” und “Architectures & Development” einbringen. Im Wahlbereich können die Studierenden verschiedene Module dieser Gebiete frei kombinieren. Manche Module werden sowohl im Kernbereich als auch im Wahlbereich angeboten. Diese Module können nur einmal belegt werden, entweder als Core Course oder als Elective Course.

Die nachfolgende Grafik zeigt die angebotenen Module im Kern- und Wahlbereich.

<u>Data & Knowledge</u>		<u>Digital Business</u>		<u>Architectures & Development</u>	
<i>Core Course</i>	<i>Elective</i>	<i>Core Course</i>	<i>Elective</i>	<i>Core Course</i>	<i>Elective</i>
<u>BI</u>		<u>DCM</u>		<u>DT</u>	
<u>EKM</u>		<u>IuL</u>		<u>MEITA</u>	
<u>FLD</u>		<u>ASM</u>		<u>PA</u>	
<u>DAIS</u>			<u>ODT</u>	<u>UXB</u>	
	<u>SAWI</u>		<u>MGPMIT</u>		<u>APM</u>
	<u>PS</u>		<u>SI</u>		<u>CSS</u>
	<u>DVS</u>		<u>DMI</u>		<u>DGS</u>
			<u>SMM</u>		
			<u>PSV</u>		
			<u>DTP</u>		
			<u>FinTech</u>		
			<u>PFI</u>		
			<u>EHRM</u>		
			<u>JUDEM</u>		

Enterprise knowledge management (EKM)

1	Module name IIS57290	Enterprise knowledge management	5 ECTS
2	Courses/lectures	Lecture: Enterprise knowledge management Tutorial: Enterprise knowledge management	5 ECTS
3	Lecturers	Prof. Dr. Sven Laumer	

4	Module coordinator	Prof. Dr. Sven Laumer
5	Contents	Lecture on demand: This module uses the “Flipped Classroom” method and provides an advanced perspective on enterprise knowledge management. It focuses on knowledge management strategy and processes, knowledge management governance, knowledge modelling and visualization as well as concepts like crowdsourcing, open innovation and crowdfunding in a knowledge management context. From a theoretical perspective, the module introduces social networks and social network analysis as base for enterprise knowledge management. Tutorial: The contents of the lecture on demand are further discussed by means of exercises and case studies. Practical exercises are conducted using common social network analysis or knowledge management software.
6	Learning objectives and skills	Students can analyze, visualize, design and discuss enterprise knowledge management approaches.
7	Recommended prerequisites	None
8	Integration in curriculum	First or third semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Data & Knowledge (Core Course or Elective) Master International Information Systems (from 2016/17): Module in the section Information Systems – Extension Courses
10	Method of examination	Lecture on demand and tutorial: written examination (90 Minutes)
11	Grading procedure	Lecture on demand and tutorial: 100% of module score
12	Module frequency	Each winter term
13	Workload	Lecture: 40h Tutorial: 40h Self-study: 70h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	TBA

Business intelligence (BI)

1	Module name IIS57043	Business intelligence	5 ECTS
2	Courses/lectures IIS70415	Lecture: Business intelligence Exercise: Business intelligence	5 ECTS
3	Lecturers	Prof. Bodendorf and colleagues	

4	Module coordinator	Prof. Bodendorf
5	Contents	Lect/Ex: The interest in data analytics has increased tremendously in the last few years, and it is part of almost every business or organization we can think of. There has been a tremendous development in the field since we all heard the term Big Data for the first time close to a decade ago. The demand for skilled practitioners has also increased significantly and is projected to keep increasing in the next years. At the same time, a qualified data scientist or data analyst is expected to have knowledge in different areas like statistics, data mining, data visualization or programming, to name a few. It is often challenging to decide where to start if one has interest in this career path. In this lecture, we introduce a variety of topics which will give you a kick start in the field of data science and will help you to continue the learning path in other, more advanced courses. We teach the whole data science process (based on the industry-wide accepted CRISP model) from the business and data understanding to the deployment and management steps. Students get familiar with terms like data science, machine learning and artificial intelligence, as well as available tools and technologies. You will learn what is behind the technology that powers everything from your shopping suggestions on Amazon to automatic systems like chatbots and self-driving cars. We teach you the most used machine learning algorithms right now: decision trees, neural networks, support vector machines, association rules (Apriori and FP Growth), clustering algorithms (k-Means, DBSCAN). In the end of the lecture, you will know the difference between machine learning and artificial intelligence, understand how the most popular algorithms work, and how they can be applied in practice. The lecture is intended for students with no prior knowledge in data analytics. After familiarizing with the relevant theory, students also have the chance to apply their knowledge on a given data set. This will be done with a data science tool that does not require any programming skills.
6	Learning objectives and skills	The students • Can describe important business intelligence and data science concepts, tools, and algorithms • Learn how to structure a data science project • Work on a practical exercise and apply the learned algorithms on a real-world dataset • Are able to evaluate a machine learning model and decide on its goodness of fit
7	Recommended prerequisites	None
8	Integration in curriculum	Second semester
9	Module compatibility	Master in International Information Systems (from 2018/19): Module in the section Information Systems– Data & Knowledge (Core Course or Elective)

		Master in International Information Systems (from 2016/17): Module in the section Information Systems– Services, processes, and intelligence I or II (Core Course or Elective) Master Arbeitsmarkt und Personal: Wahlbereich Master FACT: Vertiefungsbereich (Modulgruppe Interdisziplinäre Module) Master Marketing: Wahlpflichtbereich der Modulgruppe „Management“ bzw. „Data Science“ (MARK-54081) Master Wirtschaftsmathematik: Wahlbereich Master Wirtschaftsingenieurwesen: Informatik Nebenfach Betriebswirtschaftslehre Master Management: Vertiefungsbereich
10	Method of examination	Written examination, 90 minutes (Klausur, 90 Minuten)
11	Grading procedure	100% of exam score (100% der Klausurnote)
12	Module frequency	Each summer term
13	Workload	Contact hours: 60 h Independent study: 90 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	All relevant material will be provided during the lecture.

Foundations of linked data (FLD)

1	Module name IIS-57320	Foundations of linked data	5 ECTS
2	Courses/lectures IIS-73201	Lecture: Foundations of linked data (2 SWS) Exercise: Foundations of linked data (2 SWS)	5 ECTS
3	Lecturers	Prof. Harth (mostly lectures) and colleagues (mostly exercises)	
4	Module coordinator	Prof. Dr. Andreas Harth	
5	Contents	The Linked Data principles provide a unified interface to data and software systems based on web architecture. Linked Data is increasingly popular in scenarios where data and systems from multiple providers have to be integrated, both in an enterprise setting and on open data from the web. The module covers foundational techniques to access, process and integrate data, both from a theoretical and a practical perspective, and provides a coherent treatment of protocols and languages specified by the World Wide Web Consortium. The module combines techniques from different areas, such as databases and artificial intelligence, adapted for use in a decentralised setting on the web. The overarching topic is to facilitate data integration on the basis of resource-oriented modelling, knowledge representation, hyperlinks and state transfer between user agents and servers. The module sets out with a history of hypertext systems, followed from an introduction to web architecture and knowledge representation, including algorithms for query evaluation and deductive reasoning. The module closes with a user agents for querying integrated data from sources attainable through the web.	
6	Learning objectives and skills	You will learn how to describe data in a way that facilitates integrated access. You will be able to write queries that access large amounts of data within a unified logical framework. You will be able to apply the technologies and techniques around Linked Data to support data integration in an enterprise setting and on the web, and therefore have the necessary skills for a broad variety of data science applications.	
7	Recommended prerequisites	Students should have a basic understanding of how the internet and the web work. Some knowledge of relational databases is beneficial.	
8	Integration in curriculum	Second semester	
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Data & Knowledge (Core Course or Elective) Master International Information Systems (from 2016/17): Module in the section Information Systems – Extension courses Master in Marketing (start before WS17/18): Wahlpflichtbereich Modulgruppe “Methoden” Master in Marketing (start since WS17/18): Wahlpflichtbereich Modulgruppe “Data Science” Master Wirtschaftsingenieurswesen	
10	Method of examination	Written examination (60 minutes) (Klausur: 60 Minuten) Successful completion of all tasks in the practical exercises can lead to a grade improvement of maximum 0.4 points	
11	Grading procedure	100% of exam score	
12	Module frequency	Each summer term	
13	Workload	Contact hours: 60 h Independent study: 90 h	
14	Module duration	1 semester	
15	Teaching and examination language	English	
16	(Recommended) reading	All relevant material will be provided during the lecture. The following books give an overview of the topics of the lecture:	

		Tim Berners-Lee. Weaving the Web. Harper, 1999 Tom Heath, Christian Bizer. Linked Data: Evolving the Web into a Global Data Space. Morgan & Claypool, 2011. Dean Allemang. Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL. Morgan Kaufmann, 2008. For a brief motivation read tyfair.com/news/2018/07/the-man-who-created-the-world-wide-web-has-some-regrets
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Data Analytics for Information Systems (DAIS)

1	Module name IIS-57465	Data Analytics for Information Systems	5 ECTS
2	Courses/lectures	V: Data Analytics for Information Systems Ü: Data Analytics for Information Systems	5 ECTS
3	Lecturers	Prof. Dr. Verena Tiefenbeck; Prakhar Mehta Leonard Michels, M.Sc.	
4	Module coordinator	Prof. Dr. Verena Tiefenbeck	
5	Contents	This course provides a hands-on introduction to master the essentials of data analytics and machine learning using R. The growing ubiquity of information systems both in organizational and private consumer contexts increasingly makes large data streams available in various domains. As part of the digital transformation, knowing how to handle these data sets, how to analyze and to interpret them, becomes a more and more important skillset in companies, policymaking and in academic research. The course builds on real-world data sets from information systems in the realm of consumer behavior, in particular in the resource consumption context. Based on hands-on examples and practical challenges, we cover fundamental data analytics methods using the software environment R. The course starts with basic concepts from descriptive and inferential statistics that will be needed in the following course units, followed by an introduction to the statistics software R and R Studio. Students will be introduced to experimental design to distinguish between correlation and causation and to critically evaluate the validity and reliability of results. In the following, a large share of the course is dedicated to regression analysis, clustering, and different classification techniques. Students will apply these methods to data sets from concrete real-world challenges. The course closes with a discussion of relevant privacy regulations and also highlights social concerns and ethical aspects. In the second half of the semester, students have the possibility to earn bonus points in a course project (self-study), by applying the skills and methods covered in the lecture and exercise sessions in the analysis a large real-world dataset.	
6	Learning objectives and skills	In this course, students will acquire – an introduction (or refresher) to fundamental concepts in statistics needed for various quantitative methods in data analytics – skills to design and use information systems to collect behavioral data – skills to formulate hypotheses and to perform and explain the corresponding statistical tests – skills to formulate, solve, and interpret linear and logistic regression analyses – skills to conduct clustering analyses – skills to set up, train, and evaluate machine learning algorithms, including K-means, regression, and support vector machines – programming skills in the statistics software R that allow you to efficiently perform the related tasks – a solid understanding of the ethical issues when dealing with personal data and of the privacy regulations to follow	

7	Recommended prerequisites	An introductory part that covers essential concepts from statistics and an introduction to R is part of the course. However, a basic level of familiarity with some programming languages prior to the course is strongly recommended.
8	Integration in curriculum	1st or 3rd semester
9	Module compatibility	- Master International Information Systems (from 2018/19): Module in the section Information Systems – Data & Knowledge (Core Course or Elective) - Master Wirtschaftsingenieurwesen: allgemeines Wahlmodul (Elective) - Master Marketing: Wahlpflichtbereich der Modulgruppe „Data Science“
10	Method of examination	Written examination (90 minutes)
11	Grading procedure	Written examination (100 %) – bonus points can be acquired in a project in the second half of the semester. Students who pass the exam may increase their exam grade by up to 0.7 with the project.
12	Module frequency	Each winter term
13	Workload	Lecture and exercise sessions: 50h Self-study: 100h
14	Module duration	In WS 2020, the module will be taught in blocked sessions mainly in the first half of the semester.
15	Teaching and examination language	English
16	(Recommended) reading	Will be announced in class

Social and web intelligence (SAWI)

1	Module name IIS-53305	Social and web intelligence	5 ECTS
2	Courses/lectures IIS-33004	Social and web intelligence (4 SWS)	5 ECTS
3	Lecturers	Dr. Pavlina Kröckel	

4	Module coordinator	Prof. Bodendorf
5	Contents	Social media became an inseparable part of today's companies. The vast amount of user-generated data online gives huge advantages to companies primarily by providing them with easy access to customer data free of charge. With every action online, users leave a trace behind which companies can use for a wide variety of decisions – product development and improvement, more targeted advertising, customer support. The user data come in various forms: text, images, and videos. In this seminar, we put special focus on text and network data. We first teach the theory behind text and network mining and then apply this knowledge on given datasets.
6	Learning objectives and skills	The students - will gain theoretical knowledge and understanding behind social media, text mining, network theory and network metrics - will learn how to analyze and summarize data from a variety of web sources (e.g., Facebook, Twitter, blogs and forums) - will learn how to apply the skills in a few chosen application areas e.g., role analysis, sentiment and behaviour analysis. The lecture videos will be available via StudOn. Presence is required for two mid-term presentations (not graded) and the final presentation (graded).
7	Recommended prerequisites	- Students should have a basic familiarity with data mining and data analytics methods and tools. - The Business Intelligence lecture offered by the Information Systems II Chair each SS (or similar introductory lecture in Data Analytics) is a prerequisite to attend the course. - One of the tools which will be used in the seminar is RapidMiner (also installed on the computers in the PC Labs at Wiso)
8	Integration in curriculum	Third semester Registration is mandatory. Places are limited. Please inform yourselves about the registration process on the homepage of the Chair of Information Systems II.
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems Data & Knowledge (Electives) Master International Information Systems (from 2016/17): Module in the section Information Systems – Services, Processes, and Intelligence II (Electives) Master Marketing: Wahlpflichtbereich der Modulgruppe „Management“ Master FACT: Vertiefungsbereich (Modulgruppe Interdisziplinäre Module) Master IBS: Wahlbereich
10	Method of examination	Project work and presentation (Projektarbeit und Präsentation)
11	Grading procedure	Project work (50%) and presentation (50%) (Projektarbeit (50%) und Präsentation (50%)) The project work (mid-term tasks/open questions) are individual work while the final project presentation is evaluated as a group.
12	Module frequency	Each WS
13	Workload	Lecture: 30 h Exercise: 50 h Self-study: 70 h

14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	All relevant material will be provided during the seminar. For students that want to gain deeper understanding of social intelligence, recommendations will be given by the lecturers.

Platform strategies (PS)

1	Module name IIS57110	Platform strategies	5 ECTS
2	Courses/lectures IIS-71102 IIS-71103	Platform strategies	5 ECTS
3	Lecturers	Prof. Möslein and colleagues Prof. Srinivasan, guest lecturer from IIMB, India	

4	Module coordinator	Prof. Möslein
5	Contents	The course builds on the platform and network aspects in core strategy and aims to highlight the specific strategies for firms operating in multi-sided-markets. The course will cover most relevant concepts around platforms such as network effects, and how network effects impact/ create new business models. Core issues around platform-mediated network firms, such as standards, pricing, envelopment, and competition dynamics will be discussed. The course will be taught through a set of cases that ensures that participants appreciate the multi-dimensional nature of managing in network businesses.
6	Learning objectives and skills	The students ○ can identify and unravel the business problem in a case study and actively take part in class discussions ○ can describe platform intermediation in two sided markets, platform dominance and Winner-takes-all dynamics ○ can develop strategies for creating platform mediated networks and understand pricing in these businesses
7	Recommended prerequisites	None
8	Integration in curriculum	Third semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Data & Knowledge (Elective) Master International Information Systems (from 2016/17): Module in the section Information Systems – Innovation and Value Creation II (Elective) Master Marketing: Wahlpflichtbereich der Modulgruppe „Management“
10	Method of examination	Project report: Students develop a business plan about a platform business idea Handout: Students develop an essay about a platform of their choice, discuss key concepts encountered during the lectures and apply them to the chosen platform.
11	Grading procedure	-Project report (50%) and Handout (50%)
12	Module frequency	Each WS
13	Workload	Attendance: 30 h Independent study: 120 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	• Klemperer, P. 2005. Network effects and switching costs. In Durlauf, S.N. & Blume, L.E. (Eds.), The new palgrave dictionary of Economics, Palgrave Macmillan. • Eisenmann T., Parker, G., & Van Alstyne, M. 2006. Strategies for two-sided markets. Harvard Business Review Oct. 2006. • Hidding, G.J., Williams, J. & Sviokla, J.J. 2011. How platform leaders win, Journal of Business Strategy, 32, 2, 29-37.

		• Suarez, F.F. & Kirtley, J. 2012. Dethroning an established platform, MIT Sloan Management Review, Summer 2012. The following books are suggested for the advanced reader on the basics on network economics. • Shy O. 2001. The Economics of Network Industries, Cambridge University Press: Cambridge, England. • Gawer A, Cusumano M. 2002. Platform Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation. Harvard Business School Press: Boston, MA. • Evans D, Hagiu, A, Schmalensee, R. 2006. Invisible Engines: How Software Platforms Drive Innovation and Transform Industries, MIT Press, Boston, MA. * The cases for each lecture are to be decided.
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Deep Vision Systems (DVS)

1.	Module name IIS-57045	Development of deep vision systems	5 ECTS
2.	Courses/lectures	Lecture (2,5 SWS): Development of deep vision systems Exercise (2,5 SWS): Development of deep vision systems	2,5 ECTS 2,5 ECTS
3.	Lecturers	Prof. Dr. Patrick Zschech, Prof. Dr. Mathias Kraus, and assistants	
4.	Module coordinator	Prof. Dr. Patrick Zschech	
5.	Contents	Computer vision systems try to mimic human capabilities of visual perception to support time-consuming and labor-intensive tasks like the recognition, localization, and tracking of critical objects. Nowadays, such systems increasingly rely on methods and tools from the field of machine learning to automatically extract useful information from images that can be utilized for decision support and business automation purposes. This course provides the necessary fundamentals for the development of modern vision systems based on machine learning. The particular focus is on deep neural networks and their capabilities of automated feature learning. More specifically, we consider different types of network architectures, look at the steps of image labelling and data preparation, discuss crucial hyperparameters and evaluation criteria, and review other related aspects, such as 3D vision, hybrid intelligence, and explainable artificial intelligence. The course has a strong practical focus. At the beginning of the semester, all fundamentals are provided in lecture sessions and hands-on exercises. Afterwards, students are encouraged to work (in groups) on real projects to apply the methods and concepts learned during the teaching sessions. The results are presented and discussed at the end of the semester.	
6.	Learning objectives and skills	The students • understand the challenges for developing vision-based systems, • understand the basic principles of machine learning and deep neural networks in the realm of image processing, • explain the general pipeline of computer vision systems based on deep neural networks, • know about state-of-the art techniques at the intersection of computer vision and machine learning, • apply technologies for automated image processing in a practical setting, • compare and evaluate different system configurations, • work in groups and present their results together, • develop skills in collaborative interaction with peers.	
7.	Recommended prerequisites	Basic knowledge in data analysis techniques, statistics, and machine learning. Basic programming skills, preferably in Python. The number of participants is limited. Please see website for details on the application process.	
8.	Integration in curriculum	Second or third semester	
9.	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Data & Knowledge (Elective) Master International Information Systems (from 2016/17): Module in the section Information Systems – Extension Courses (Elective)	
10.	Method of examination	Project report and presentations, partly in groups (Projektarbeit und Präsentation, z.T. in Gruppenarbeit)	

11.	Grading procedure	Project report (80%) and presentation (20%) (Projektarbeit (80%) und Präsentation (20%))
12.	Module frequency	Each semester (without guarantee)
13.	Workload	Contact hours: 75 h Independent study: 75 h
14.	Module duration	1 semester
15.	Teaching and examination language	English
16.	(Recommended) reading	All relevant material will be provided during the course.

Digital change management (DCM)

1	Module name IIS-56210	Digital change management	5 ECTS
2	Courses/lectures	Lecture (2 SWS): Digital change management Excercise (2 SWS): Digital change management	2,5 ECTS 2,5 ECTS
3	Lecturers	Prof. Dr. Sven Laumer	

4	Module coordinator	Prof. Dr. Sven Laumer
5	Contents	Lecture: This module provides an organizational and social perspective of the digital transformation. It introduces theories and methods to analyze, visualize, and discuss challenges of the acceptance of the digital transformation. Case study: Using research methods (interviews, surveys) students should investigate a digital transformation project and analyze its design and acceptance. The results should be presented as an own case study (case study paper, presentation). The case study is conducted as group work.
6	Learning objectives and skills	Students can analyze, visualize and discuss consequences of the digital transformation for individuals and organizations as well as its implementation challenges. Students are able to design an implementation project to focus especially on end-users.
7	Recommended prerequisites	None
8	Integration in curriculum	Second or forth semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Digital Business (Core Course or Elective) Master International Information Systems (from 2016/17): Module in the section Information Systems – Extension Courses (Elective) Master Management: Vertiefungsbereich
10	Method of examination	Lecture: written examination (60 Minutes) Exercise: case study, the case study is done as a group
11	Grading procedure	Lecture: 50% of module score Excercise: 50% of module score, evaluated as a group
12	Module frequency	Sommersemester
13	Workload	Lecture: 40h, Excercise:40h, Self-study: 70h
14	Module duration	1 Semester
15	Teaching and examination language	Teaching: English Examination: English
16	Recommended reading	Alter, S. (2013). Work System Theory: Overview of Core Concepts, Extensions, and Challenges for the Future. Journal of the Association for Information Systems, 14 (2), 72-121 Kotter, J.P. (2005). Out Iceberg is Melting. St.Martin's Press, Kotter, J.P. (2010). Leading Change, Harvard Business Press Venkatesh, V., Morris, M., Davis, G., and Davis, F. D. 2003. "User acceptance of information technology: toward a unified view," MIS Q (27:3), pp. 425–478.

Innovation and leadership (IuL)

1.	Module name IIS-57053	Innovation and leadership	5 ECTS
2.	Courses/lectures IIS70508 IIS70509	Innovation and leadership (4 SWS)	5 ECTS
3.	Lecturers	Prof. Möslin and colleagues	

4.	Module coordinator	Prof. Möslin
5.	Contents	The lecture focuses on the challenges of leading and communicating innovation and change in IT enabled companies and networked organizations. Based upon that, creating a sustainable innovative environment is a leadership task. In order to succeed at this task, leaders must develop innovative abilities to deal with the challenges inherent in a business environment characterized by fluid, unstructured and changing information. The aim of this course is thereby twofold. First, the course delineates and describes different yet emerging innovation tools, organizing them into a coherent set of classes. Each class of tools is described using a set of up-to-date business cases that depict the current status of the information systems. The second aim of this course is to get an overview of how to structure leadership systems towards innovation, how leaders can motivate to foster innovative thinking and what new forms of innovation (e.g. open innovation) mean for the definition of leadership. In doing so, this lecture represents an Idea Transformation Class as students are encouraged not only to merely develop, but to actively deploy specifically developed concepts.
6.	Learning objectives and skills	The students • will understand and explore the theories and practicalities of leadership in open innovation contexts. • will gain knowledge on leading and communicating innovation and translate it in leadership behavior in real case contexts. • will learn to assess, reflect and feedback the impact of practical leadership for innovation
7.	Recommended prerequisites	- Basic understanding of innovation management - Basic understanding of management processes - First experience in team projects
8.	Integration in curriculum	First semester
9.	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Digital Business (Core Course or Elective) Master International Information Systems (from 2016/17): Module in the section Information Systems – Innovation and Value Creation I (Core Course) Master Marketing: Wahlpflichtbereich der Modulgruppe „Management“ Master Management: Vertiefungsbereich
10.	Method of examination	Lect/Ex: Research project (tw. In Gruppenarbeit) and Presentation (Vorlesung/Übung: Projektarbeit (tw. In Gruppenarbeit) und Präsentation)
11.	Grading procedure	Lect/Ex: Research project (tw. In Gruppenarbeit) (100%) and Presentation (passed) (Vorlesung/Übung: Projektarbeit (tw. In Gruppenarbeit) (100%) und Präsentation (bestanden))
12.	Module frequency	Each WS
13.	Workload	Attendance: 45 h Self-study: 105 h
14.	Module duration	1 semester
15.	Teaching and examination language	English
16.	(Recommended) reading	<i>Huff, Möslin & Reichwald: Leading Open Innovation; 2013</i> MIT Press, ISBN-13: 978-0262018494

Advanced service management (ASM)

1	Module name IIS57085	Advanced service management	5 ECTS
2	Courses/lectures IIS70839	Lecture: Advanced service management Exercise: Advanced service management	5 ECTS
3	Lecturers	Prof. Bodendorf and colleagues	

4	Module coordinator	Prof. Bodendorf
5	Contents	Lecture and exercise: This module consists of two parts. Part one of the module provides an overview of service science. Characteristics of service design, production, and deployment are presented. The second part focuses on service businesses, such as finance, commerce, logistics, tourism, education, entertainment, healthcare and industrial services. Digital products and value added services are discussed as well as service engineering and service technologies (e.g., self service systems, multimedia, and security Systems).
6	Learning objectives and skills	The students • can plan and develop services, as well as independently utilize IT-aided methods to create services. • understand the special requirements of different industries and develop service concepts on this basis. • analyse and discuss case studies in the service sector
7	Recommended prerequisites	None
8	Integration in curriculum	Second semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Digital Business (Core Course or Elective) Master International Information Systems (from 2016/17): Module in the section Information Systems – Services, Processes and Intelligence I or II (Core Course or Elective) Master Marketing: Wahlpflichtbereich der Modulgruppe „Management“ Master Management: Vertiefungsbereich Master Wirtschaftspädagogik, Studienrichtung I: Wahlbereich Master Sozialökonomik: Vertiefungsbereich Master Arbeitsmarkt und Personal: Wahlbereich Master FACT: Vertiefungsbereich (Modulgruppe Interdisziplinäre Module) Master Economics: Wahlbereich Master IBS: Wahlbereich
10	Method of examination	Written examination, 90 minutes (Klausur, 90 Minuten)
11	Grading procedure	100% of exam score (100% der Klausurnote)
12	Module frequency	Each SS
13	Workload	Attendance: 60 h + Self-study: 90 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	All relevant material will be provided during the lecture.

Organizing for digital transformation (ODT)

1	Module name IIS56421	Organizing for digital transformation	5 ECTS
2	Courses/lectures IIS64211 IIS64212	Organizing for digital transformation (4 SWS)	5 ECTS
3	Lecturers	Prof. Möslin and colleagues	
4	Module coordinator	Prof. Möslin	
5	Contents	The course focusses on dynamics in organizational transformation driven through information technology (IT) and consists of two parts. The first part introduces the topic from an industrial perspective and explores the re-organization of value streams in the course of the digital transformation. Teaching in this part includes contributions from a German automotive company. Students will work in a project-oriented mode for half the lecture and then present their results. The second part takes the perspective of academic research on the organization of the digital transformation. It introduces different theoretical frameworks to gain a deeper understanding of the phenomenon and explores its implications for global business structures. Students write a short essay to show what they have learned. Together, the lecture allows the students to gain theoretical knowledge on the digital transformation and acquire practical problem-solving skills as well to work effectively on innovative projects in the field.	
6	Learning objectives and skills	The students • are familiar with different theories of works systems and service systems and their practical application • know more about the contribution of information technology in managing complex innovation activities • have an improved understanding of the global IT Industry and various strategies that are used • can identify and unravel the business problem in a case study and actively take part in class discussions	
7	Recommended prerequisites	- general knowledge of digital technology and their economic applications - basic understanding of simple software applications - first experience with team projects	
8	Integration in curriculum	Second or fourth semester	
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Digital Business (Elective) Master in International Information Systems (from 2016/17): Module in the section Information Systems – Innovation and Value Creation II (Elective) Master IBS: elective courses (Wahlbereich) Master in Management: Vertiefungsbereich	
10	Method of examination	Presentation and seminar paper (Präsentation und Seminararbeit)	
11	Grading procedure	Presentation (30%) and seminar paper (70%) (Präsentation (30%) und Seminararbeit (70%))	
12	Module frequency	Each SS, starting in SS 2022	
13	Workload	Attendance: 60 h + Independent study: 90 h	
14	Module duration	1 semester	
15	Teaching and examination language	English	

16	(Recommended) reading	None
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Managing global projects (MGP) + Managing information technology (MIT)

1	Module name IIS57060	Managing global projects and information technology	5 ECTS
2	Courses/lectures IIS70603 IIS70604	Lect1/Ex1: Managing information technology (2 SWS) Lect2/Ex2: Managing global projects (2 SWS)	2,5 ECTS 2,5 ECTS
3	Lecturers	Prof. Amberg and colleagues	

4	Module coordinator	Prof. Amberg
5	Contents	Lect1/Ex1: The traditional role of the Chief Information Officer (CIO) as gatekeeper of technology and protector of corporate information asset activities is changing. Next to the daily duties to keep the IT operations and projects running – often facing shrinking budget constraints – an enterprise IT manager becomes an important business partner in supporting the transformation of the traditional business to the digital age. The course has a strong focus on the role of IT within different types of enterprises and highlights IT from two different angles: IT as organizational function and IT as driver of organizational transformation. The lecture is divided into two parts (1) IT Management in enterprises (2) IT-driven business models Lect2/Ex2: Increasing globalization of business operations and the high importance of project structures for global operations force companies worldwide to develop and strengthen their capabilities for managing global projects. Therefore, future professionals capable of successfully coordinating projects across multiple countries and cultures will have excellent career prospects. To prepare students for the task of managing global projects, the course will focus on the following topics: • Characteristics and organization of global projects • Cultural influences (effects and remedies) • Controlling of globally distributed projects • Challenges of IS outsourcing/offshoring projects For each of these topics, students will be given an introduction to the topic (knowledge transfer) and then work on real-world examples to gain deeper insights into the topic (knowledge application). In addition, students will work in teams on a project during the semester.
6	Learning objectives and skills	Lect1/Ex1: The students • describe and explain key IT Management models • explain and evaluate design options of an IT organization and challenges of the CIO • explain main organizational IT cost categories and tasks of managing IT costs • describe components of a (digital) business model • evaluate (digital) business models • understand the impact of new technologies, such as Big Data Technologies, on value creation Lect2/Ex2:

		The main goal of the course is to familiarize students with the foundations of successful management in global IT-projects. The students will: • describe the project life cycle • evaluate challenges caused by distance in globally distributed projects and learn about the approaches of dealing with them • evaluate IT archetypes and decision domains • evaluate PMOs in (IT) organization analyze different collaboration tools
7	Recommended prerequisites	Lect1/Ex1: None Lect2/Ex2: Basic knowledge on project management principles and techniques
8	Integration in curriculum	Third semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Digital Business (Elective) Master in International Information Systems (from 2016/17): Module in the section Information Systems – IT Management I or II (Core Course or Elective)
10	Method of examination	Lect1/Ex1: Written assignment (100%) (Vorlesung 1/ Übung 1: Hausarbeit (100%)) Lect2/Ex2: Presentation (33,33%), class participation (33,33%) and discussion paper (33,33%) (Vorlesung 2/ Übung 2: Diskussionspapier (2 mal 1 Seite – 33,33%), Diskussionsbeitrag (33,33%), Präsentation (2x15 Minuten – 33,33%))
11	Grading procedure	Lect1/Ex1: 50% of module score (Vorlesung 1/ Übung 1: 50 % der Modulnote) Lect2/Ex2: 50% of module score (Vorlesung 2/ Übung 2: 50 % der Modulnote)
12	Module frequency	Each WS
13	Workload	Contact hours: 60 h Independent study: 90 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	Lect1/Ex1: Carr, N. G. (2003): IT doesn't matter. Harvard Business Review, 81(5), 41–9, 128. Christensen, C. M., & Overdorf, M. (2000). Meeting the Challenge of Disruptive Change. Harvard Business Review, 78(2), 66–76. Lect2/Ex2: Binder J.: Global Project Management: Communication, Collaboration and Management Across Borders. Gower Publishing Ltd, ISBN: 0566087065.

Service innovation (SI)

1	Module name IIS-57241	Service innovation	5 ECTS
2	Courses/lectures IIS72411 IIS72412	Service innovation	5 ECTS
3	Lecturers	Prof. Dr. Roth, Prof. Dr. Möslin, and colleagues	

4	Module coordinator	Prof. Möslein
5	Contents	Services now account for over 80% of all transactions in developed economies, but typically receive much less R&D attention than products. Developing service innovations demands a clear strategy from businesses with four interlocking core elements: search, selection, implementation and evaluation of innovative concepts. If even one of these phases is not been clearly thought through, the entire innovation process is likely to collapse. This course focuses on successful approaches, methods, tools and efforts to develop service innovations. Further information can be found on www.wi1.fau.de .
6	Learning objectives and skills	The students can: • learn about items, notions, characteristics and special features in innovation management for services, service design methods and cases. • learn to judge and discuss innovation management tasks and alternative solutions with respect to the specialties of services. • experience methods of service design by themselves in interactive lectures, gain a feeling for suitable methods and learn to reflect different effects. • apply their knowledge and competences in solving cases and thereby analyze selected issues of managing, developing and innovating services. • work together in international small work groups, present their results in English, give feedback to other students' work and discuss different solution approaches.
7	Recommended prerequisites	- Basic understanding of product and service business processes - General knowledge on management and strategy - Openness to work interactively and in interdisciplinary and international teams
8	Integration in curriculum	Second semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Digital Business (Elective) Master in International Information Systems (from 2016/17): Module in the section Information Systems – Innovation and Value Creation II (Elective) Master Management: Vertiefungsbereich Master Wirtschaftspädagogik, Studienrichtung I: Wahlbereich Master Sozialökonomik: Vertiefungsbereich Master Arbeitsmarkt und Personal: Wahlbereich Master Economics: Wahlbereich Master IBS: core course (Pflichtbereich)
10	Method of examination	Seminar paper and presentation (Seminararbeit und Präsentation)
11	Grading procedure	Seminar paper (partly group work) (70%) and presentation (partly group work) (30%)
12	Module frequency	SS
13	Workload	Contact hours: 30 h Independent study: 120 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	Specific literature will be listed in the course

Create your fintech startup (FinTech)

1	Module name MIM-57381	Create your fintech startup	5 ECTS
2	Courses/lectures	Lecture and case studies (2 SWS): Create your fintech startup Practice session (2 SWS): Create your fintech startup	5 ECTS
3	Lecturers	Prof. Dr. Steffi Haag	

4	Module coordinator	Prof. Dr. Steffi Haag
5	Contents	Students explore the entrepreneurial process using a learning by doing methodology in the fintech industry. The lecture and case studies sessions provide and discuss tools and methods of creating, visualizing, and analyzing digital business models (e.g., business model canvas, lean startup, design thinking). In a group project, students transfer and apply those tools to the fintech industry by creating, planning, and pitching their own fin-/insurtech startup ideas.
6	Learning objectives and skills	Students • can model, analyze, and discuss digital business models and its components • can assess the specific opportunities for and challenges of fin-/insurtech businesses • can create, plan, and implement novel fintech startups • can pitch their fintech idea in front of peers and experts • can present, assess, and give feedback to novel fintech business models • can collaborate with peers of different competences.
7	Recommended Prerequisites	None. The number of participants is limited. Please see website for details on the application process!
8	Integration in curriculum	2nd or 4th semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Digital Business (Elective) Master International Information Systems (from 2016/17): Module in the section Information Systems – Extension Courses (Elective) Master FACT: Vertiefungsbereich (Modulgruppe Interdisziplinäre Module) Master International Business Studies: Elective course – Free specialization module (Area studies: Europe) Master Management: Vertiefungsbereich Master in Economics: free elective modules Master in Marketing: Wahlmodul in der Modulgruppe „Management“ Master Wirtschaftsingenieurwesen Master Arbeitsmarkt und Personal: Wahlbereich Master Wirtschaftspädagogik, Studienrichtung I: fachwissenschaftlicher Pflichtbereich; Studienrichtung II: fachwissenschaftlicher Wahlbereich Master Sozialökonomik: freier Vertiefungsbereich
10	Method of examination	Businessplan and presentations in groups
11	Grading procedure	Businessplan (40%), online presentations (50%), class participation (10%)
12	Module frequency	Each SS
13	Workload	Contact hours: 60 h Independent study: 90 h
14	Module duration	1 Semester, in blocked sessions
15	Teaching and examination language	English

16	(Recommended) reading	Al-Debei, M. M.; Avison, D. (2010): Developing a unified framework of the business model concept. European Journal of Information Systems, 19, 359-376. Blank, S.; Dorf, B. (2012): The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company, K & S Ranch Dorfleitner, G., Hornuf, L., Schmitt, M., Weber, M. (2017): Definition of fintech and Description of the fintech Industry, in G. Dorfleitner et al., fintech in Germany, Springer International Publishing, DOI 10.1007/978-3-319-54666-7_2 Osterwalder, A; Pigneur, Y. (2010): Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, John Wiley & Sons Osterwalder, A; Pigneur, Y.; Bernarda, G; Smith, A. (2014): Value Proposition Design: How to Create Products and Services Customers Want, John Wiley & Sons Ries, E. (2011): The Lean Startup: How Constant Innovation Creates Radically Successful Businesses, Portfolio Penguin, London. Further literature is provided in the course sessions.
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Praxisseminar: Innovative Versicherungsprodukte (PSV)

1	Modulbezeichnung FACT-52580	Praxisseminar: Innovative Versicherungsprodukte (Seminar: Innovative insurance products)	5 ECTS
2	Lehrveranstaltungen	S: Entwicklung und Vermarktung innovativer Versicherungsprodukte (4 SWS) (Development and marketing of innovative insurance products)	
3	Lehrende	Prof. Gatzert und Mitarbeiter/innen / Prof. Steul-Fischer und Mitarbeiter/innen	
4	Modulverantwortliche/r	Prof. Gatzert / Prof. Dr. Steul-Fischer	
5	Inhalt	Das interdisziplinäre Praxisseminar - veranstaltet von dem Lehrstuhl für Versicherungswirtschaft und Risikomanagement und dem Lehrstuhl für BWL, insb. Versicherungsmarketing sowie einem Praxispartner - vermittelt den Studierenden praxisnahe Kenntnisse zu (Produkt-) Entwicklungen und der Vermarktung von innovativen Versicherungsprodukten in Versicherungsunternehmen.	
6	Lernziele und Kompetenzen	Studierende können: - eigenständig innovative Versicherungsprodukte konzipieren - Risiken identifizieren und die Risikosituation bewerten - innovative Vermarktungskonzepte entwickeln - anhand einer Abschlusspräsentation wesentliche Inhalte vorstellen	
7	Empfohlene Voraussetzungen für die Teilnahme	Grundlegende Kenntnisse der Versicherungswirtschaft sind hilfreich. Die Anmeldung erfolgt per E-Mail an katrin.osterrieder@fau.de (beschränkte Teilnehmerzahl- Auswahl auf Basis der Studienleistungen und des Lebenslaufs)	
8	Einpassung in Musterstudienplan	3. Semester	
9	Verwendbarkeit des Moduls	Master International Information Systems (from 2018/19): Module in the section Information Systems – Digital Business (Elective) Master International Information Systems (from 2016/17): Module in the section Information Systems – Extension Courses (Elective) Master FACT: Vertiefungsbereich (Modulgruppe Finance and Insurance) Master Management: Vertiefungsbereich (Modulgruppe Sonstiges) Master Wirtschaftsingenieurwesen: Wahlbereich (Grundlagen FACT) Master Marketing mit Studienbeginn ab WS17/18: Wahlmodul in der Modulgruppe „Interdisziplinäre Module“ Master Marketing mit Studienbeginn vor WS17/18: Wahlmodul in der Modulgruppe „Sonstiges“	

10	Studien- und Prüfungsleistungen	- Seminararbeit (15-20 Seiten) und Präsentation (15-30 Minuten, inklusive Protokoll zur Präsentation) in Gruppenarbeit. Es handelt sich um eine einheitliche Prüfung, bei der die einzelnen Teilleistungen untrennbar miteinander verbunden sind. Für das Bestehen des Moduls müssen nach § 19 Abs. 1 Satz 4 MPOWIWI in der jeweils geltenden Fassung alle Teilleistungen in demselben Semester bestanden werden. Wegen des untrennbaren Bezugs der Teilleistungen aufeinander ist abweichend von § 25 Abs. 1 Satz 2 MPOWIWI eine Wiederholung nur einer der nicht bestandenen Teilleistungen nicht möglich. Das Nichtbestehen einer der Teilleistungen erfordert die Wiederholung der gesamten Prüfung.
11	Berechnung Modulnote	Seminararbeit (50%) und Präsentation (50%)
12	Turnus des Angebots	Jedes Semester
13	Arbeitsaufwand	Präsenzzeit: 60 h + Eigenstudium: 90 h
14	Dauer des Moduls	1 Semester
15	Unterrichts- und Prüfungssprache	Deutsch
16	(Vorbereitende) Literatur	Wird in der Veranstaltung bekannt gegeben

Digital transformation project (DTP)

1	Module name IIS-57171	Digital transformation project	5 ECTS
2	Courses/lectures IIS71711 IIS71712	Digital transformation project (2+2 SWS)	5 ECTS
3	Lecturers	Prof. Dr. Roth, Prof. Dr. Möslin, and colleagues	

4	Module coordinator	Prof. Möslin
5	Contents	In this module, students will focus on developing and evaluating solutions for organizational challenges in the context of digital transformation. In doing so, they work together with organizations from various industries and gain in-depth experience in solving organizational problems using a systematic design science research process. Moreover, they will get familiar with empirical research methods and improve their presentation as well as writing skills.
6	Learning objectives and skills	The students • possess comprehensive, detailed, and specialized problem solving skills in the context of digital transformation • can independently plan and carry out design science research processes • can situationally identify, collect and analyze relevant organizational data • are familiar with the topic of digital transformation and its effects on organizational stakeholders
7	Recommended prerequisites	None
8	Integration in curriculum	First semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Digital Business (Elective) Master International Information Systems (from 2016/17): Module in the section Customized Introduction to IIS (Management)

		Master in Management: Vertiefungsbereich Master Marketing: Wahlpflichtbereich der Modulgruppe „Management“
10	Method of examination	Seminar paper and presentation (Seminararbeit und Präsentation)
11	Grading procedure	Seminar Paper (partly group work) (70%) and presentation (partly group work) (30%)
12	Module frequency	Each SS
13	Workload	Attendance: 60 h Self-study: 90 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	Presented in class

Patenting for Innovation (PFI)

1	Module name IIS-57172	Patenting for innovation	5 ECTS
2	Courses/lectures	Patenting for innovation	5 ECTS
3	Lecturers	Dr. Grill, Prof. Möslein and colleagues	

4	Module coordinator	Prof. Möslein
5	Contents	Intellectual Properties (IPs) in general and especially patents play an important role in innovation in any Hightech society. This topic is multi-faceted and can be accessed from different viewpoints: business, politics, legal framework, organization, etc. In this course, we will focus on: - the introduction to IPs and patents in general, - the role of IPs and patents in research, development and (open) innovation, - the patent exploitation through licensing contracts and patent pools, - the patent policies in the European Union, China and USA.
6	Learning objectives and skills	The students: • learn to understand the role of patenting in the innovation process, • gain deeper insights into the roles of IP in various types of businesses, • study the role of IP and patents in different regions and contexts (Asia, United States, Europe).
7	Recommended prerequisites	None
8	Integration in curriculum	Third semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Digital Business (Elective) Master in International Information Systems (from 2016/17): Module in the section Information Systems – Innovation and Value Creation II (Elective) Master International Business Studies: elective course Master Management: Vertiefungsbereich
10	Method of examination	Seminar paper (Seminararbeit)
11	Grading procedure	Seminar paper (100%) (Seminararbeit)
12	Module frequency	Each WS
13	Workload	Contact hours: 30 h Independent study: 120 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	Literature will be announced and distributed in the first sessions.

Electronic Human Resources Management (EHRM)

1	Module name IIS- 57086	Electronic human resources management	5 ECTS
2	Courses/lectures	Electronic human resources management (E-HRM)	5 ECTS
3	Lecturer	Prof. Dr. Sven Laumer	

4	Module coordinator	Prof. Dr. Sven Laumer
5	Contents	This course focuses on the use and development of digital technologies for the management of human resources in an organizational context. The lecture and the content provided will address theories, methods and digital technologies and provide students with the necessary knowledge for the identification ("discovery"), design ("development"), diffusion ("diffusion") and evaluation ("impact") of digital innovations in human resource management. This phase of knowledge transfer uses an e-learning module, which combines different media. In the context of the application of the knowledge transferred, students are instructed to lead discussions on exercises or case studies. For this purpose, problems from the practice of human resources work are described and students should discuss them with the theories and methods presented or develop suggestions for the use of digital technologies. In the context of knowledge implementation, students are accompanied by a case study analysis to apply the theories and methods. In the virtual design, the case study of the FAUBank will be used in the course for this purpose. Agenda: – Part A: Technical basics of E-HRM – Part B: Social Media in HRM – Part C: Data-driven approaches and their use with HR – Part D: Challenges and opportunities of E-HRM
6	Learning objectives and skills	The general learning and qualification objective of the module is to enable students to gain knowledge about the use and development of digital technologies in human resources management, to explain the effects of digital technologies on human resources management (HRM) and to design digital innovations for HRM.
7	Recommended prerequisites	Registration via the vhb (www.vhb.org) is necessary to gain access to the StudOn course.
8	Integration in curriculum	First or third term
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Digital Business (Elective) Master in International Information Systems (from 2016/17): Module in the section Information Systems – IT Management II (Elective) Master Arbeitsmarkt und Personal: Elective Master Wirtschaftspädagogik, Studienrichtung I: Elective Master Wirtschaftspädagogik, Studienrichtung II: Zweifach Wirtschaftsinformatik Erweiterungsprüfung Berufliche Schulen/Studienfach Wirtschaftspädagogik
10	Method of examination	Lec/Ex: Written examination 90 minutes
11	Grading procedure	Lec/Ex: 100% of exam score
12	Module frequency	Summer and winter term (Start in winter term 2020/2021!)

13	Workload	Lecture: 40h Excercise: 40h Independent study: 70h
14	Module duration	1 Semester
15	Teaching and examination language	German and English
16	(Recommended) reading	References are provided during the lectures

Judgment in decision making and evidence-based management (JUDMEM)

1	Module name IIS- 56216	Judgment in decision making and evidence-based management	5 ECTS
2	Courses/lectures	Lecture (2 SWS): Judgment in decision making and evidence-based management	5 ECTS
3	Lecturers	Prof. Dr. Verena Tiefenbeck	
4	Module coordinator	Prof. Dr. Verena Tiefenbeck	
5	Contents	While today's companies and individuals have access to more and more data, most decisions are taken on limited and imperfect information. Consequently, various fields require their practitioners to have an in-depth understanding of judgment and decision-making. Examples include the development of user interfaces and marketing strategies, hiring decisions, crisis intervention, as well as policy-making in education, healthcare, or social services. This course examines how people make choices, judge situations, probabilities, and decision options. The focus is on the contrast between rational decision-making, and the psychological principles that guide decision behavior. The course reviews common heuristics, cognitive errors and systematic biases that help us to make reasonable and accurate decisions in some areas, but may crucially misguide us in others. We will develop tools to detect and mitigate systematic cognitive biases and we will identify strategies that tap into these insights for improved decision-making in diverse real-world contexts, both in simple everyday-life situations and complex managerial decision environments.	
6	Learning objectives and skills	Student are able to • describe key psychological processes involved in judgment and decision making. • explain when and why those processes lead to (more or less) accurate and inaccurate judgments. • identify and describe common judgment and decision heuristics and biases. • apply the acquired knowledge to examples and problems from business and public policy. • explain the methodology (experiments and field studies) used to study judgment and decision making and apply it to new real-world applications. • critically reflect upon the way how they and others take common decisions in daily life. • work together in international small work groups, summarize key takeaways from behavioral studies, and present their results in English.	
7	Recommended prerequisites	None	
8	Integration in curriculum	Second or forth semester	
9	Module compatibility	Master International Information Systems (from 2018/19 + 2016/17): Elective in the section Digital Business Master Wirtschaftsingenieurwesen: Allgemeines Wahlmodul	
10	Method of examination	<i>Change due to Corona situation:</i> Written exam and project (creating a short educational video clip)	
11	Grading procedure	<i>Change due to Corona situation:</i> Written exam (60%), project (40%)	
12	Module frequency	Each summer term	
13	Workload	Contact hours: 30 h Independent study: 120 h	

14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	All relevant material will be provided during the seminar.

Designing technology (DT)

17	Module name IIS-57073	Designing technology	5 ECTS
18	Courses/lectures IIS70732 IIS70733	Designing technology	5 ECTS
19	Lecturers	Prof. Möslin and colleagues	

20	Module coordinator	Prof. Möslin
21	Contents	This course aims to teach students on how to design innovative artifacts to extend human and organizational capabilities, following the design science paradigm. Understanding the design science paradigm and its application will enable students to develop knowledge on the management and use of information technology for managerial purposes and effectively communicate this knowledge. Students will also be introduced to innovation technologies in the context of artificial intelligence and augmented reality that can link and enable different types of innovation technologies across the boundaries of socio-technical systems. They will also be introduced to social and technological theories and literature such as systems theory, communication theory and basics of open innovation and user innovation. Students will use this knowledge on current technologies and theory to work on a (design science) project that solves human or organizational problems. The course requires analytical thinking, where students can identify and clearly articulate problems that they would like to solve and the process of solution finding. While existing technical knowledge from students is welcome, it is not a prerequisite for the course. Students can also contribute by conducting theoretical/empirical research, along with developing IT artifacts. To conclude, the course offers a balance between creativity and scientific thinking, which can be of immense help to students seeking to learn either skill or both.
22	Learning objectives and skills	The students: • can develop knowledge on the management and use of information technology for managerial purposes • can differentiate between and assess the most important developments on the Web. • develop a research design for a design science project. • discuss theories, as well as the design and the progress of their project.
23	Recommended prerequisites	Basic knowledge of web technologies (i.e. basic html or understanding of web technology in general) or knowledge of empirical methods to evaluate designed artifacts
24	Integration in curriculum	Third semester
25	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Architectures & Development (Core Course or Elective) Master in International Information Systems (from 2016/17): Module in the section Information Systems – Innovation and Value Creation II (Elective)
26	Method of examination	Lect/Ex: Research project (70%) and written assignments (30%) (Vorlesung/ Übung: Projektarbeit (70%) und Hausarbeit (30%))

27	Grading procedure	Lect/Ex: Research project (70%) and written assignments (30%) (Vorlesung/ Übung: Projektarbeit (70%) und Hausarbeit (30%))
28	Module frequency	Each WS
29	Workload	Contact hours: 30 h Independent study: 120 h
30	Module duration	1 semester
31	Teaching and examination language	English
32	(Recommended) reading	Baldwin, C. Y., & Clark, K. B. (2004). Modularity in the Design of Complex Engineering Systems. In <i>Complex Engineered Systems Understanding Complex Systems</i>, 175–205. Kroes, P. (2010). Engineering and the dual nature of technical artefacts. <i>Cambridge Journal of Economics</i>, 34 (1), 51–62. Hevner, A. R., March, S. T., Park, J. & Ram, S. (2004). Design Science in Information Systems Research. <i>MIS Quarterly: Management Information Systems</i>, 28 (1), 75-106. Fichman, R., Dos Santos, B., & Zheng, Z. (2014). Digital Innovation as a Fundamental and Powerful Concept in the Information Systems Curriculum. <i>MIS Quarterly: Management Information Systems</i>, 38, 329–353. Hevner, A.R., 2007. A Three Cycle View of Design Science Research. <i>Scand. J. Inf. Syst.</i> © Scand. J. Inf. Syst. 19, 87–92. Peppers, K., Tuunanen, T., Rothenberger, M.A., Chatterjee, S., 2007. A Design Science Research Methodology for Information Systems Research. <i>J. Manag. Inf. Syst.</i> 24, 45–78.

Managing enterprise-wide IT architectures (MEITA)

1	Module name IIS-57030	Managing enterprise-wide IT architectures	5 ECTS
2	Courses/lectures IIS70303 and IIS70302	Lecture.: Fundamentals of enterprise-wide IT architecture management (2 SWS) Exercise: Case study seminar (2 SWS)	2,5 ECTS 2,5 ECTS
3	Lecturers	Prof. Amberg and colleagues	

4	Module coordinator	Prof. Amberg
5	Contents	Lecture: Fundamentals of Enterprise-Wide IT Architecture Management The lecture “Fundamentals of Enterprise-Wide IT Architecture Management” provides the fundamentals of business process management and the underlying IT architecture. The course has a strong focus on concepts of business-IT-alignment e.g., service oriented architectures, cloud computing, and enterprise-wide IT systems as well as important paradigms to (re-) design enterprise IT architectures. Case Study Seminar Managers and business leaders in the field of information technology must make decisions with limited information and a swirl of business activities going on around them. They are required to evaluate options, make choices, and find solutions to the challenges they face every day. In this seminar, students will take on the perspective of a decision-maker by analyzing and discussing complex management challenges illustrated in different case studies from leading business schools.
6	Learning objectives and skills	Lecture: Fundamentals of Enterprise-Wide IT Architecture Management Students... • know about the major differences of process and workflow management, • know about the main models of IT Service Management and Business-IT Alignment, • can understand the impact of Big Data Technologies on Value Creation, can assess and implement different types of Big Data Systems, • can explain the major differences of automated communication concepts like EDI, XML and EDIFCAT, • can assess process standardization in different environments. Case Study Seminar Students should... • know about real-world challenges in the area of IT management, as well as methods for analyzing case studies, • be able to apply the vocabulary, theory, and methods they have learned in the lecture, • be able to develop solutions to business problems, as well as defend their solutions and discuss them critically in a group setting • be able to present solutions to case study problems in English.
7	Recommended prerequisites	None
8	Integration in curriculum	Second semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Architectures & Development (Core Course or Elective)

		Master in International Information Systems (from 2016/17): Module in the section Information Systems – IT Management I or II (Core Course or Elective)
10	Method of examination	Lecture: written examination 60 minutes (100%) (Vorlesung: Klausur, 60 Minuten) Case Study Seminar: Presentation (33,33%), class participation (33,33%) and discussion paper (33,33%) (Präsentation (2 x 15 Minuten – 33,33%), Diskussionsbeitrag (2 x 90 Minuten – 33,33%), Diskussionspapier (2 x 1 Seite – 33,33%))
11	Grading procedure	Lecture: 50% of module score (Vorlesung: 50% der Modulnote) Case Study Seminar: 50% of module score (Seminar: 50% der Modulnote)
12	Module frequency	Each SS
13	Workload	Contact hours: 60 h Independent study: 90 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	Lecture: Rood, M. A. Enterprise architecture: Definition, content, and utility, in Proceedings of the Third Workshop on: Enabling Technologies: Infrastructure for Collaborative Enterprises, 1994, pp. 106-111. Case Study Seminar: Ellet, W. <i>The Case Study Handbook: How to Read, Discuss, and Write Persuasively About Cases</i> . Harvard Business Review Press, 2007.

Process analytics (PA)

1	Module name IIS-54760	Process analytics (PA)	5 ECTS
2	Courses/lectures	Process analytics (4 SWS)	5 ETCS
3	Lecturers	Sandra Zilker, Willi Trang, Prof. Dr. Martin Matzner	

4	Module coordinator	Prof. Dr. Martin Matzner
5	Contents	The course deals with data-driven analysis of business processes. Therefore, different technical, organizational and business aspects of process improvement are discussed with Process Mining being at the center of attention. The module has a strong practical focus and encourages students to apply methods and concepts learned during the lecture. In the group project the students will apply their knowledge using state-of-the-art process mining tools (e.g., Celonis).
6	Learning objectives and skills	The students - capture the concepts around process improvement and recognize the potentials for organizations - understand technical aspects of data-driven process analysis - know about state-of-the art technologies for process mining - apply technologies for data extraction and analysis in a practical setting - analyze a business process and develop a business case for process improvements - work in groups and present their results together
7	Recommended prerequisites	Beneficial: Basic understanding of business processes and process notations / modelling (see <i>Advanced process management</i>)
8	Integration in curriculum	First or third semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Architectures & Development (Core Course or Elective) Master International Information Systems (from 2016/17): Module in the section Information Systems – Extension Courses (Elective) Master FACT: Vertiefungsbereich (Modulgruppe Interdisziplinäre Module)
10	Method of examination	written examination (60 minutes) and group presentations
11	Grading procedure	Written examination (30%) and group presentation (70%)
12	Module frequency	Each WS
13	Workload	Contact hours: 60 h Independent study: 90 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	None

User experience in a business context (UXB)

1	Module name IIS-57451	User experience (UX) in a business context	5 ECTS
2	Courses/lectures	Lecture (2 SWS): UX in a business context Practice session (2 SWS): UX in a business context	5 ECTS
3	Lecturers	Prof. Dr. Steffi Haag	

4	Module coordinator	Prof. Dr. Steffi Haag
5	Contents	Organizations have started to realize that designing and maintaining great user experience (UX) is the best way to build trust, retention, and loyalty of staff and customers alike. The lecture - teaches the key concepts, methods, and approaches that help design, measure, and manage total UX across the organization and drive value propositions of digital business models. - discusses established and new methods of UX research for (further) developing digital technologies. - introduces frameworks to build and lead teams of UX researchers, designers, engineers, product managers. - employs case studies to transfer and discuss the application of UX design, research, and management in practice. In the practice sessions, (groups of) students practically apply UX research methods and tools (e.g., user journeys) to investigate users' experiences in interaction with state-of-the-art digital technology prototypes, and to deduce implications for product and organizational strategy, development, and design. The results are presented towards peers and/or experts from research and industry.
6	Learning objectives and skills	Students can define, discuss, and apply the concepts, methods, and tools of analyzing and managing the experiences users perceive in interaction with new digital technologies of organizations. Students are able to measure and analyze user experiences of novel technologies and infer recommendations for technology and policy design and development. Students can present user research results towards peers. Students develop skills in collaborative interaction with peers.
7	Recommended Prerequisites	None. The number of participants is limited. Please see website for details on the application process!
8	Integration in curriculum	1st or 3rd semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Architectures & Development (Core Course or Elective) Master International Information Systems (from 2016/17): Module in the section Information Systems – Extension Courses (Elective) Master FACT: Vertiefungsbereich (Modulgruppe Interdisziplinäre Module) Master International Business Studies: Elective course - Free specialization module (Area studies: Europe) Master Management: Vertiefungsbereich Master Marketing: Wahlmodul in der Modulgruppe "Management" Master Wirtschaftsingenieurwesen
10	Method of examination	Project report and presentations, partly in groups
11	Grading procedure	Project report (30%), online presentations (70%)
12	Module frequency	Each WS
13	Workload	Contact hours: 60 h Independent study: 90 h
14	Module duration	1 Semester

15	Teaching and examination language	English
16	(Recommended) reading	Relevant literature is provided during the course.

Advanced process management (APM)

1	Module name IIS-57083	Advanced process management	5 ECTS
2	Courses/lectures IIS70817	Lecture: Advanced process management (2 SWS) Exercise: Advanced process management (2 SWS)	5 ECTS
3	Lecturers	Prof. Bodendorf and colleagues	

4	Module coordinator	Prof. Bodendorf
5	Contents	Lecture and Exercise: This course is about strategic business process planning and business IT alignment. Additionally, it covers business process analysis, planning, engineering, monitoring and controlling. Furthermore, it provides a comprehensive understanding of workflow management systems, service-oriented architectures, intelligent agents and assistants as well as process portals.
6	Learning objectives and skills	The students • select suitable process architectures and organizational structures within the scope of business process management. • can model, analyze, and implement (with the aid of IT) complex processes. • independently transfer business process management concepts to new use cases. • solve weekly exercises to deepen the understanding of the lecture contents
7	Recommended prerequisites	None
8	Integration in curriculum	First or third semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Architectures & Development (Elective) Master International Information Systems (from 2016/17): Module in the section Information Systems – Services, Processes and Intelligence II (Elective) Master Management: Vertiefungsbereich Master Wirtschaftsingenieurwesen Master International Production Engineering and Management Informatik Nebenfach Betriebswirtschaftslehre Master FACT: Vertiefungsbereich Master IBS: Wahlbereich
10	Method of examination	Written examination 90 minutes (Klausur 90 Minuten)
11	Grading procedure	100% of exam score (100% der Klausurnote)
12	Module frequency	Each WS
13	Workload	Contact hours: 60 h Independent study: 90 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	Fundamentals of Business Process Management, Springer, ISBN 978-3-642-33142. For more information see http://www.wi2.fau.de

Case solving seminar (CSS)

1	Module name IIS-57250	Case solving seminar	5 ECTS
2	Courses/lectures IIS70101	Case solving seminar (4 SWS)	5 ECTS
3	Lecturers	Prof. Bodendorf and colleagues	

4	Module coordinator	Prof. Bodendorf
5	Contents	The course relies on cases to understand and solve problems in real business situations. Students may work in teams and apply their theoretical knowledge in solving the cases. This will provide the students an opportunity to develop key skills such as communication, group working and problem solving skills.
6	Learning objectives and skills	The students • can independently analyze and solve problems in real-world situations. • conduct the discussion of complex problem-solving approaches in groups and present their work results.
7	Recommended prerequisites	None
8	Integration in curriculum	Third semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Architectures & Development (Elective) Master in International Information Systems (from 2016/17): Module in the section Customized Introduction to IIS (Management)
10	Method of examination	Seminar paper (Seminararbeit) and presentation (Präsentation)
11	Grading procedure	Seminar paper 100% (Seminararbeit 100%) and presentation passed (Präsentation bestanden)
12	Module frequency	Each semester
13	Workload	Contact hours: 60 h Independent study: 90 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	All relevant material will be provided during the seminar.

Designing Gamified Systems (DGS)

1	Module name IIS-57046	Designing gamified systems (DGS)	5 ECTS
2	Courses/lectures	Lecture + Capstone Project (4 SWS)	5 ETCS
3	Lecturers	Prof. Dr. Benedikt Morschheuser, industry partners (e.g. from Daimler AG)	

4	Module coordinator	Prof. Dr. Benedikt Morschheuser
5	Contents	Driven by the rising popularity of (video) games, technology, business and society are increasingly influenced and penetrated by games and trends of the gaming industry. One of the probably most important phenomena of this multi-faceted development is “gamification”, which addresses the use of design principles and features from games in information systems, process or service design. Gamification’s popularity stems from the notion that games are a pinnacle form of hedonic information systems and thus are particularly effective in invoking intrinsic motivation and experiences such as autonomy, mastery, flow, immersion, relatedness and overall enjoyment. Across industries, marketers, designers and developers are thus using gamification as a design approach when engineering digital products and services with the purpose of inducing gameful experiences, influencing human motivation and even change behavior in various contexts. This course • teaches the key concepts, design patterns, and approaches of motivational, hedonic (i.e. games and video games), social and gamified information systems. • offers deep insights into advanced concepts and theoretical foundations of game design, motivational psychology, and information system design. • introduces methods and frameworks for designing gamified systems and managing gamification projects. • discusses latest research findings and the potential impact of gamification on society, economy and everyday life. Capstone Project: The course is complemented with a practical design project, where students in a team select and apply design methods & techniques in order to create a prototype of a gamified / hedonic information system. Within this project the students can apply knowledge and skills acquired in this lecture and their studies in a challenging context. The results are presented towards peers and/or experts from research and/or industry.
6	Learning objectives and skills	The students gain knowledge in understanding the underlying design principles of gamified and hedonic information systems and are able to analyze and discuss such systems. The students learn state-of-the-art methods, techniques and tools for successfully conducting gamification projects and are able to select and apply them. The students train their creativity and prototyping skills. Further they can improve their collaboration and presentation skills.
7	Recommended prerequisites	Motivation to work in an international and interdisciplinary group on a challenging topic. Creativity, prototyping skills, or development experiences can be helpful. The number of participants is limited. Please see website for details on the application process!

8	Integration in curriculum	First, second, third and fourth semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Information Systems – Architectures & Development (Elective) Master International Information Systems (from 2016/17): Module in the section Information Systems – Extension Courses (Elective) Master Wirtschaftsingenieurwesen (Elective) Master Elektrotechnik-Elektronik-Informationstechnik (Elective) Master Information and Communication Technology (Elective)
10	Method of examination	Project report that needs to be presented: The students create a project report (max. 20 pages, partly group work), which describes the developed prototype of a gamified or hedonic information system (e.g. a gamified app, information system or a game). The report is presented together with the developed prototype in a presentation.
11	Grading procedure	Project report: 40% of module score (partly group work) Presentation of the project report: 60% of module score (partly group work)
12	Module frequency	SS
13	Workload	Contact hours: 60 h Independent study: 90 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	Koivisto, J & Hamari, J. (2019). The rise of motivational information systems: A review of gamification research. International Journal of Information Management, 45. pp. 191-210. Morschheuser, B., Hassan, L., Werder, K., Hamari, J. (2018). How to design gamification? A method for engineering gamified software. Information & Software Technology, 95. pp. 219-237. Radoff, J. (2011). Game On: Energize Your Business with Social Media Games. Wiley, USA. Salen, K. (2004). Rules of play: game design fundamentals. MIT Press, Cambridge, USA. ...further literature will be made available in the lecture.

Study Abroad Courses

1	Module name IIS-57262	Study abroad courses (Information systems)	¹⁾
2	Courses/lectures	Study abroad courses (Information systems)	¹⁾
3	Lecturers	Staff at exchange university	

4	Module coordinator	Prof. Bodendorf, Prof. Möslein, Prof. Amberg
5	Contents	Courses students will be attending during the exchange semester in one of the partner universities or others should fit into the area Information systems thus extending the student's knowledge and competencies in this field of study. The suitability of the courses will be assessed by the programme coordinator.
6	Learning objectives and skills	Students acquire additional knowledge and competencies in their field of study
7	Recommended prerequisites	Learning agreement
8	Integration in curriculum	Third semester
9	Module compatibility	Master International Information Systems: Module in the section Information Systems (Elective)
10	Method of examination	In accordance with exam regulations of the exchange university
11	Grading procedure	In accordance with grading key and credits of the course
12	Module frequency	In accordance with the curriculum of the exchange university
13	Workload	In accordance with the specific course and the credits of the course
14	Module duration	1 semester
15	Teaching and examination language	Tbd in the course
16	(Recommended) reading	Tbd in the course

¹⁾ 5, 10 or 15 ECTS

V Informatics

🇬🇧 The Informatics part is made up of “Core Courses” and “Electives” worth 15 ECTS each. Students have to earn 5 ECTS in the Core Courses of each of the subject areas “Data & Knowledge”, “Digital Business” and “Architectures & Development”. Within the electives students can freely combine different modules of these subject areas and the extension courses. Some modules are included in the core courses as well as in the electives. These modules can only be taken once, either as a core or an elective course.

The graph below shows the available options for the Core Courses and Electives.

🇩🇪 Der Bereich Informatics besteht aus „Core Courses“ (Kernbereich) und „Electives“ (Wahlbereich) mit jeweils 15 ECTS. Die Studierenden müssen jeweils 5 ECTS aus den Kernbereichen der Gebiete “Data & Knowledge”, “Digital Business” und “Architectures & Development” einbringen. Im Wahlbereich können die Studierenden verschiedene Module dieser Gebiete und der Extension Courses frei kombinieren. Manche Module werden sowohl im Kernbereich als auch im Wahlbereich angeboten. Diese Module können nur einmal belegt werden, entweder als Core Course oder als Elective Course.

Die nachfolgende Grafik zeigt die angebotenen Module im Kern- und Wahlbereich.

<u>Data & Knowledge</u>		<u>Digital Business</u>		<u>Architectures & Development</u>	
<i>Core Course</i>	<i>Elective</i>	<i>Core Course</i>	<i>Elective</i>	<i>Core Course</i>	<i>Elective</i>
<u>InfoVis</u>		<u>HCI</u>		<u>SWE-GL+Kons</u>	
<u>DW + TS</u>		<u>OSS-COSS-VUE</u>		<u>POIS</u>	
<u>IntroPR</u>		<u>DSES</u>		<u>SPM</u>	
<u>OSS-NYT-VUE</u>		<u>HumSecPri</u>			<u>TSWS</u>
	<u>MW-VU</u>	<u>ForensInf</u>			<u>OOAD</u>
	<u>SaM 1</u>	<u>CryptoCur</u>			<u>ADAP</u>
	<u>SaM 2</u>	<u>EinflITSec</u>			<u>ARCH</u>
	<u>PR</u>	<u>IT-Modern</u>			<u>SoSys3</u>
	<u>OSS-NYT-PROJ</u>	<u>InnoLab</u>			<u>SWE-ZUV</u>
	<u>AppVis</u>	<u>AMOS-PO</u>			<u>SWE-GL + DP</u>
	<u>KI I</u>	<u>FoundCrypt</u>			<u>SWE-GL+SWE-PR</u>
	<u>KI II</u>				<u>SWE-PR+DP</u>
	<u>PA</u>				<u>SWE-VV</u>
	<u>DL</u>				<u>EBTEIS</u>
	<u>OSS-SAKI-VUE</u>				

Data Warehousing and Transaction Systems

1	Module name 237521	Data warehousing und Transaktionssysteme (Data warehousing and transaction systems)	5 ECTS
2	Courses/lectures	Lecture: Data warehousing und Transaktionssysteme	
3	Lecturers	Transaction Systems: Prof. Richard Lenz Data Warehousing: Prof. Thomas Ruf	

4	Module coordinator	Prof. Thomas Ruf, Prof. Richard Lenz
5	Contents	DW: Das "Data Warehouse" ist sowohl im theoretischen Bereich der Datenbankforschung als auch in der praktischen Anwendung in der Wirtschaft ein wichtiges Thema. Die Hauptaspekte der Vorlesung liegen dabei in der Diskussion der unterschiedlichen Architekturansätze, der zugehörigen Datenmodelle und der verarbeitungstechnischen Grundlagen. Weiterhin wird auf aktuelle Techniken wie ROLAP und MOLAP oder Aggregatbildung, -verwendung und -haltung eingegangen. Die Vorlesung ist geprägt von einer Mischung aus theoretischen Grundlagen und Anwendungen neuer Forschungsergebnisse. Dabei berichten Praktiker aus Unternehmen zum einen von ihren Erfahrungen bei dem Aufbau eines "Warehouses" und stellen zum anderen den Stand der Technik in einschlägigen Data-Warehouse- Systemen dar. TAS: Transactions are the core mechanism to guarantee database consistency in the presence of failures. The lecture introduces the cornerstones of the Transaction Concept and related techniques and system architectures. Topics are: • Reconstructing the Transaction Model • Advanced Transaction Models • Queued transaction processing • Implementing the ACID properties of transactions: Concurrency control, logging and recovery • TP Monitors: TRPC, Architecture of TP Monitor, Transaction Manager This course generalizes the transaction concept from its traditional database system domain to the broader context of client-server computing. The course begins by defining basic terminology and concepts. The role of a transaction processing system in application design, implementation, and operation is covered. Subsequent lectures cover the theory and practice of implementing locking, logging, and the more generic topic of implementing transactional resource managers.
6	Learning objectives and skills	DW: Die Studierenden • kennen verschiedene Anwendungsgebiete des Data Warehousing und charakterisieren diese; • modellieren multidimensionale Datenbanken;

		• entwickeln ein Grundverständnis für die Abbildung multidimensionaler Datenstrukturen in Datenbanken und bewerten die Vor- und Nachteile der verschiedenen Ansätze in konkreten Anwendungssituationen; • setzen grundlegende Verfahren der Datenauswertung in Data Warehouse-Systemen für konkrete Anwendungssituationen ein; • erläutern die Architektur und den Betrieb technischer Data Warehouse-Systeme und erläutern die sich hieraus ergebenden Implikationen im Betrieb solcher Systeme; • erklären die von Praxisvertretern vorgestellten Einsatzszenarien und Systemansätzen für Data Warehouse-Systeme; • schätzen aktuelle Entwicklungen im Themengebiet ein. TAS: Die Studierenden: • erklären die Zielsetzungen und Grenzen transaktionaler Systeme; • unterscheiden verschiedene erweiterte Transaktionsmodelle; • erläutern wie die Verfügbarkeit verteilter transaktionaler Systeme durch „Queued Transactions“ verbessert werden kann; • erklären typische Nebenläufigkeitsanomalien; • erläutern mit konkreten Beispielen was Wiederherstellbarkeit und Striktheit bedeuten; • erklären Ziele und Funktionsweise von Sperrverfahren, hierarchischen Sperrverfahren und zusätzlichen Sperrmodi; • erläutern Isolationsstufen zur Abschwächung des Synchronisationsaufwands; • erklären die grundlegenden Aufgaben und Funktionen eines „Recovery Managers“; • unterscheiden verschiedene Klassen von Wiederherstellungsalgorithmen; • erklären Zweck und Funktionsweise von „Checkpoints“ und „Fuzzy Checkpoints“; • erklären im Detail wie das Zwei-Phasen Freigabeprotokoll funktioniert; • erläutern Ziele und Funktionsweise des Drei-Phasen-Freigabeprotokolls und Paxos-Commit; • erläutern die Funktionsweise verteilter Transaktionssysteme auf der Basis der standardisierten Schnittstellen in X-Open/DTP.
7	Recommended prerequisites	Konzeptionelle Modellierung Implementierung von Datenbanksystemen
8	Integration in curriculum	2./4. semester
9 10	Module compatibility	Master IIS Core Course Data&Knowledge

11	Method of examination	Data Warehousing und Transaktionssysteme (DWTAS) (Prüfungsnummer: 237521) (englische Bezeichnung: Data warehousing and transaction systems) Prüfungsleistung, mehrteilige Prüfung Anteil an der Berechnung der Modulnote: 100% weitere Erläuterungen: DW wird geprüft in einer Klausur von 60 Minuten TAS wird mündlich geprüft in ca. 30 Minuten. Prüfungssprache: Deutsch
12	Grading procedure	50% DW & 50% TAS
13	Module frequency	Each sommer semester
14	Workload	Contact hours: 60 h Independent study: 90 h
15	Module duration	1 Semester
16	Teaching and examination language	English (TAS) and German (DW)
17	(Recommended) reading	-

Information Visualization (InfoVis)

1	Modulbezeichnung 299892	Informationsvisualisierung Information visualization	5 ECTS
2	Lehrveranstaltungen	Vorlesung zur Informationsvisualisierung Übung zur Informationsvisualisierung	
3	Lehrende	Dr. Grosso	

4	Modulverantwortliche/r	Dr. Grosso
5	Inhalt	• Aufgrund der rasanten Entwicklung der Informationstechnologie sind wir mit einer noch nie dagewesenen Flut an Daten konfrontiert: • 250.000.000 Fotos werden täglich auf Facebook geladen • Weltweit finden 130.000.000 VISA-Transaktionen statt • Täglich werden über 500 Millionen Tweets gesendet Informationsvisualisierung befasst sich mit der graphischen Darstellung abstrakter Daten, die keine räumliche Struktur aufweisen. Die Visualisierung abstrakter Daten nutzt visuelle Metaphern und Interaktion, um Information aus den Daten zu extrahieren. Typische Anwendungsszenarien sind die Analyse von Finanztransaktionen oder sozialen Netzwerken, Bioinformatik, Geographie, Textanalyse oder Visualisierung von Software-Quellcode. • In dieser Vorlesung werden unterschiedliche Techniken vorgestellt, um verschiedenen Arten von Daten zu visualisieren. Insbesondere werden folgende Themen behandelt: • Graphen und Netzwerke • Dynamische Graphen • Hierarchien und Bäume • Multivariate Daten • Time-Series Daten • Textvisualisierung • Visualisierung Biologischer Daten
6	Lernziele und Kompetenzen	Die Studierenden: - listen und identifizieren die unterschiedlichen Algorithmen der Informationsvisualisierung - veranschaulichen die Methoden zur Visualisierung von Graphen und Netzwerke und bestimmen ihre Unterschiede - klassifizieren Algorithmen zur Visualisierung multivariater Daten und erklären ihrer Funktionsweise - erklären und charakterisieren Techniken für die Text-Visualisierung und veranschaulichen die Methoden zur Visualisierung zeitabhängiger Daten - lernen Visualisierungswerkzeuge kennen und wenden diese zur Lösung praxisrelevanter Aufgaben der Informationsvisualisierung - sind in der Lage, die vorgestellten Algorithmen der Informationsvisualisierung in JavaScript zu implementieren
7	Empfohlene Voraussetzungen für die Teilnahme	Algorithmik kontinuierlicher Systeme
8	Einpassung in Musterstudienplan	3. Semester
9	Verwendbarkeit des Moduls	Master International Information Systems (from 2018/19): Module in the section Informatics – Data & Knowledge (Core Course or Elective) Master in International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective)
10	Studien- und Prüfungsleistungen	Klausur (90 Min.) Klausur in elektronischer Form mit einem Anteil im Antwort-Wahl-Verfahren

11	Berechnung Modulnote	VORL: 100% der Modulnote
12	Turnus des Angebots	Jährlich im Wintersemester
13	Arbeitsaufwand	Präsenzzeit: 60h Eigenstudium: 90h
14	Dauer des Moduls	1 Semester
15	Unterrichts- und Prüfungssprache	Deutsch
16	(Vorbereitende) Literatur	• Robert Spence: Information Visualization: Design for Interaction • Stuart K. Card, Jock Mackinlay, Ben Shneiderman: Readings in Information Visualization – Using Vision to Think • Benjamin B. Bederson, Ben Shneiderman: The Craft of Information Visualization – Readings and Reflections

Introduction to pattern recognition (IntroPR)

1	Module name 902664	Introduction to pattern recognition	5 ECTS
2	Courses/lectures	Lecture: Introduction to pattern recognition (3 SWS) Exercise: Introduction to pattern recognition (1 SWS)	
3	Lecturers	Vincent Christlein	

4	Module coordinator	Andreas Maier
5	Contents	The goal of this lecture is to familiarize the students with the overall pipeline of a pattern recognition system. The various steps involved from data capture to pattern classification are presented. The lectures start with a short introduction, where the nomenclature is defined. Analog-to-digital conversion is discussed with a focus on how it impacts further signal analysis. Commonly used preprocessing methods are then described. A key component of pattern recognition is feature extraction. Thus, several techniques for feature computation will be presented including Walsh transform, Haar transform, linear predictive coding (LPC), wavelets, moments, principal component analysis (PCA) and linear discriminant analysis (LDA). The lectures conclude with a basic introduction to classification. The principles of statistical, distribution-free and non-parametric classification approaches will be presented. Within this context we will cover Bayesian and Gaussian classifiers, as well as artificial neural networks.
6	Learning objectives and skills	The students • explain the general pipeline of a pattern recognition system • understand sampling, the sampling theorem, and quantization • apply methods to decompose signals into sine and cosine functions • apply various vector quantization methods • apply histogram equalization and histogram stretching • compare different thresholding methods • apply the principle of maximum likelihood estimation to Gaussian probability density functions • understand linear shift-invariant filters and convolution • apply various low- and high-pass filters, as well as non-linear filters (homomorphic transformations, cepstrum, morphological operations, rank operations) • apply various normalization methods • understand the curse of dimensionality • explain various heuristic feature extraction methods, e.g. projection to orthogonal bases (Fourier transform, Walsh/Hadamard transform, Haar transform), Linear Predictive Coding, geometric moments, feature extraction via filtering, wavelets) • understand analytic feature extraction methods, e.g. Principal Component Analysis, Linear Discriminant Analysis • define the decision boundary between classes • compare different objective functions for feature selection • explain the principles of statistical classification (optimal classifier, cost functions, Bayes classifier) • understand different classifiers (Gauss classifier, polynomial classifier, non-parametric classifiers such as k-nearest neighbor classifier, Parzen windows, neural networks) and compare them w.r.t. their decision boundaries, their computational complexity, etc.

		• use the programming language Python to apply the presented pattern recognition techniques • get to know practical applications and apply the presented algorithms to problems in practice
7	Recommended prerequisites	A pattern recognition system consists of the following steps: sensor data acquisition, pre-processing, feature extraction, and classification/machine learning. This course focuses mainly on the first three steps and is the basis of our master courses (Pattern Recognition and Pattern Analysis).
8	Integration in curriculum	3. semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Data & Knowledge (Core Course or Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective) Master Marketing: Wahlpflichtbereich der Modulgruppe „Data Science“ Master Marketing: Wahlpflichtbereich der Modulgruppe „Methoden“ (gültig für Studierende mit Studienbeginn bis WS 2016/17)
10	Method of examination	Oral examination (30 min)
11	Grading procedure	100% of the exam grade
12	Module frequency	Each winter semester
13	Workload	Contact hours: 60 h Independent study: 90 h
14	Module duration	1 Semester
15	Teaching and examination language	English
16	(Recommended) reading	lecture slides Heinrich Niemann: Klassifikation von Mustern, 2. überarbeitete Auflage, 2003 Sergios Theodoridis, Konstantinos Koutroumbas: Pattern Recognition, 4th edition, Academic Press, Burlington, 2009 Richard O. Duda, Peter E. Hart, David G. Stock: Pattern Classification, 2nd edition, John Wiley & Sons, New York, 2001

Nailing your thesis (OSS-NYT-VUE)

1	Module name 480491	Nailing your thesis (OSS-NYT-VUE)	5 ECTS
2	Courses/lectures	Nailing your thesis (4 SWS)	5 ECTS
3	Lecturers	Prof. Riehle	

4	Module coordinator	Prof. Riehle, M.B.A.
5	Contents	This course teaches students how to perform scientific research for their final thesis or a research paper. The goal is to prepare students for a Bachelor or Master research thesis. The course covers the following topics: • Science and society • The research process • Exploratory research • Confirmatory research • Writing a thesis/paper • The scientific community Students can choose one or both of two components: VUE (lecture + exercise), 4 SWS, 5 ECTS. VUE combines lectures with homework and exercises. VUE is run as a 3h block. PROJ (small research project), 2 SWS, 5 ECTS. In PROJ, students perform a small research project, either individually or in teams. The available projects will be presented at the beginning of the course. Students perform the research, write a paper, and hold a presentation about their work. The overall schedule can be found at https://goo.gl/VqoFO . Please sign up for the course on StudOn (link accessible through schedule spreadsheet) as soon as possible.
6	Learning objectives and skills	• Understand how to perform research • Understand how to write a research thesis
7	Recommended prerequisites	None
8	Integration in curriculum	NYT can be taken in these variants: • VUE (4 SWS, 5 ECTS) • PROJ (4 SWS, 5 ECTS) • VUE + PROJ (8 SWS, 10 ECTS) NYT is available to Informatik (Bachelor und Master), Wirtschaftsinformatik (Bachelor) and IIS (Master) students. NYT is also available to other degree programs, see UnivIS. NYT is available as an (ungraded) Schlüsselqualifikation.
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Data & Knowledge (Core Course or Elective) or Master International Information Systems (from 2016/17 + 2018/19): Module in the section Seminar International Information Systems or Master International Information Systems (from 2016/17): Module in the section Informatics Applied Software Engineering I or II (Core Course of Elective)
10	Method of examination	- In-class participation - Homework assignments

11	Grading procedure	Classwork (40%) + homework (60%)
12	Module frequency	Every two semesters
13	Workload	60h in class, 90h pre- and post-work
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	See http://nythesis.com

Nailing your thesis (OSS-NYT-PROJ)

1	Module name 580491	Nailing your thesis (OSS-NYT-PROJ)	5 ECTS
2	Courses/lectures	Nailing your thesis (4 SWS)	5 ECTS
3	Lecturers	Prof. Riehle	

4	Module coordinator	Prof. Riehle, M.B.A.
5	Contents	This course teaches students how to perform scientific research for their final thesis or a research paper. The goal is to prepare students for a Bachelor or Master research thesis. The course covers the following topics: • Science and society • The research process • Exploratory research • Confirmatory research • Writing a thesis/paper • The scientific community Students can choose one or both of two components: VUE (lecture + exercise), 4 SWS, 5 ECTS. VUE combines lectures with homework and exercises. VUE is run as a 3h block. PROJ (small research project), 2 SWS, 5 ECTS. In PROJ, students perform a small research project, either individually or in teams. The available projects will be presented at the beginning of the course. Students perform the research, write a paper, and hold a presentation about their work. The overall schedule can be found at https://goo.gl/VqoFO . Please sign up for the course on StudOn (link accessible through schedule spreadsheet) as soon as possible.
6	Learning objectives and skills	• Understand how to perform research • Understand how to write a research thesis
7	Recommended prerequisites	None
8	Integration in curriculum	NYT can be taken in these variants: • VUE (4 SWS, 5 ECTS) • PROJ (4 SWS, 5 ECTS) • VUE + PROJ (8 SWS, 10 ECTS) NYT is available to Informatik (Bachelor und Master), Wirtschaftsinformatik (Bachelor) and IIS (Master) students. NYT is also available to other degree programs, see UnivIS. NYT is available as an (ungraded) Schlüsselqualifikation.
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Data & Knowledge (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Applied Software Engineering II (Elective)
10	Method of examination	Project work
11	Grading procedure	Project work (100%)
12	Module frequency	Every two semesters

13	Workload	150h project work
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	See http://nythesis.com

Simulation and modeling I (SaM 1)

1	Module name TEC 97090	Simulation und Modellierung 1 Simulation and modeling 1	5 ECTS
2	Courses/lectures	Simulation and modeling 1 (Vorlesung) Exercises to simulation and modeling 1 (Übung) Supervised computer hours for simulation and modeling 1 (Übung)	2,5 ECTS 2,5 ECTS
3	Lecturers	Prof. German	

4	Module coordinator	Prof. German
5	Contents	Overview of the various kinds of simulation - discrete simulation (computational concepts, simulation of queuing systems, simulation in Java, professional simulation tools) - required probability concepts and statistics, modeling paradigms (e.g., event/process oriented, queuing systems, Petri nets, UML statecharts) - input modeling (selecting input probability distributions) - random number generation (linear congruential generators and variants, generating random variates) - output analysis (warm-up period detection, independent replications, result presentation) - continuous and hybrid simulation (differential equations, numerical solution, hybrid statecharts) - simulation software, case studies, parallel and distributed simulation.
6	Learning objectives and skills	Students - gain knowledge about methods and realization possibilities of discrete simulation with an outlook on other types of simulation - gain knowledge of statistical aspects of simulation that are important for practice - apply statistical methods for analysis and evaluation of input and output data - gain hands-on experience with commercial simulation tools - gain experience in simulation in various fields of application (including computer networks, manufacturing systems, material flow systems) - independently develop simulation models on the basis of sample tasks using different modeling paradigms can work in groups cooperatively and responsibly
7	Recommended prerequisites	basic programming skills, preferably in Java, mathematics skills in analysis, such as taught in the first semester in applied mathematics
8	Integration in curriculum	Third semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Data & Knowledge (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective)
10	Method of examination	Written exam (90minutes) (Klausur (90 Minuten)) Erfolgreiche Teilnahme an der Übung ist Voraussetzung für die Teilnahme an der Prüfung. Bei geringer Teilnehmerzahl (< 20) erfolgt die Prüfung mündlich.
11	Grading procedure	Written exam (100%)
12	Module frequency	Each winter term
13	Workload	60 hours in class 90 hours self study
14	Module duration	1 semester
15	Teaching and examination language	English (bei Bedarf auch Deutsch)
16	(Recommended) reading	Law, "Simulation Modeling and Analysis", 5th ed., McGraw Hill, 2014

Simulation and modeling II (SaM 2)

1	Module name 502170	Simulation und Modellierung 2 Simulation and modeling 2	7,5 ECTS
2	Courses/lectures	Simulation and modeling 2 (Vorlesung) Simulation and modeling 2 exercises (Übung)	2,5 ECTS 5 ECTS
3	Lecturers	Prof. German	

4	Module coordinator	Prof. German
5	Contents	The class is project-oriented: participants conduct one larger simulation project in a team (3-4 students). The simulation project covers all typical phases including project planning, requirements analysis, data collection, input modeling, conceptual modeling, verification, validation, simulation runs, output analysis, result presentation and documentation. The lecture covers: - simulation project management, presentation, and documentation techniques - detailed simulation project case studies, - advanced topics in simulation such as variance reduction techniques, rare event simulation, parallel and distributed simulation, standards-based simulation, and combination of simulation with testing. The project teams also present their results in the lectures. The exercises are used for team meetings. Implementations, simulation runs, etc. can be performed on computing facilities of the Computer Science 7 Group with commercial/academic simulation packages (e.g., AnyLogic/OM-neT++/ns-3/SimTAny) in reserved computer hours. Possible projects encompass but are not restricted to: elevators, university canteen (Mensa), crossing with traffic lights, gas station, supermarket, hospital emergency reception, flexible manufacturing system, houses or neighborhood with renewable energy systems, battery powered devices. Own project ideas are possible and welcome.
6	Learning objectives and skills	Students get • hands-on experience in applying the theory of “Simulation and Modelling I” and in realizing simulation studies • skills in using professional (both commercial and/or academic) simulation software • skills in project and team work • training in simulation project management, presentations, documentation knowledge of advanced topics in simulation such as variance reduction, distributed simulation, validation techniques
7	Recommended prerequisites	Simulation and Modeling I
8	Integration in curriculum	4. Semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Data & Knowledge (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective)
10	Method of examination	Oral examination (30 minutes) (mündliche Prüfung (30 Minuten))
11	Grading procedure	Oral exam (100%)
12	Module frequency	Each summer term
13	Workload	60 hours in class 90 hours self study

14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	Law, "Simulation Modeling and Analysis", 5th ed., McGraw Hill, 2014

Middleware – Cloud computing (MW-VU)

1	Modulbezeichnung MSC 44585	Middleware - Cloud Computing V+Ü Middleware - Cloud Computing L+E	5 ECTS
2	Lehrveranstaltungen	Middleware - Cloud Computing (Vorlesung, 2 SWS, Dozent: Dr.-Ing. Tobias Distler) Übungen zu Middleware - Cloud Computing (Übung, 2 SWS, Dozent: Dr.-Ing. Tobias Distler)	2,5 ECTS 2.5 ECTS
3	Lehrende	Dr.-Ing. Distler	

4	Modulverantwortliche/r	Dr.-Ing. Distler
	Inhalt	• Überblick Cloud Computing • Grundlagen verteilter Programmierung (Web Services/SOAP/REST) • Virtualisierung als Basis für Cloud Computing • Infrastructure as a Service (IaaS) am Beispiel von Eucalyptus und Amazon EC2 • Verteilte Programmierung für datenlastige Cloud-Anwendungen • Skalierbare Verarbeitung von großen Datenmengen • Interoperabilität und Multi-Cloud Computing • Fehlertoleranz und Sicherheit im Kontext von Cloud Computing • Aktuelle Forschungstrends (z.B. einbruchstolerante Systeme)
5	Lernziele und Kompetenzen	Die Studierenden • nennen unterschiedliche Ausprägungen von Cloud-Computing. • erläutern verschiedene Cloud-Architekturen. • stellen Vor- und Nachteile von Cloud-Computing gegenüber. • beschreiben die Bestandteile des SOAP-Nachrichten-Frameworks und ihre jeweiligen Funktionen. • unterscheiden die Herangehensweisen bei der Entwicklung von SOAP- im Vergleich zu REST-Anwendungen. • organisieren den Austausch von Informationen in einer verteilten Anwendung unter Verwendung eines Verzeichnisdienstes. • wenden WSDL zur Beschreibung von Web-Services an. • erproben die automatische Erzeugung von Proxy-Objekten auf Basis von WSDL-Beschreibungen. • entwickeln eigene auf Web-Services basierende Anwendungen. • erläutern die Anforderungen an ein virtualisiertes System. • beschreiben die für die Virtualisierung eines Systems erforderlichen Kriterien. • vergleichen zwischen unterschiedlichen Virtualisierungstechniken und -ebenen. • schildern den Aufbau und die Funktionsweise von Xen und Linux-VServer. • erproben das Einrichten eines Abbilds für eine virtuelle Maschine. • entwickeln einen Dienst zur Speicherung von Schlüssel-Wert-Paaren. • skizzieren die Architektur einer Infrastruktur-Cloud sowie die Aufgabenbereiche hierfür zentraler Komponenten am Beispiel von Eucalyptus. • erproben das Bereitstellen von Anwendungen in einer Infrastruktur-Cloud. • zeigen die Grundlagen Software-definierter Netzwerke am Beispiel von Onix und B4 auf. • bewerten verschiedene im Bereich Cloud-Computing zum Einsatz kommende Datenspeichersysteme (Google File System, Bigtable, Windows Azure Storage, Amazon Dynamo) hinsichtlich der Kriterien Verfügbarkeit, Konsistenz und Partitionstoleranz. • erläutern eine auf Vektoruhren basierende Methode zur Auflösung im Zusammenhang mit letztendlicher Konsistenz auftretender Konflikte. • entwickeln ein verteiltes Dateisystem nach dem Vorbild von HDFS, das auf die Speicherung großer Datenmengen ausgelegt ist.

		• erkunden das Bereitstellen selbst entwickelter Dienste mittels Docker. • erstellen ein Framework zur parallelen Bearbeitung von Daten nach dem Vorbild von MapReduce. • konzipieren eigene MapReduce-Anwendungen zur Verarbeitung strukturierter Rohdaten. • diskutieren die Fehlertoleranzmechanismen in Google MapReduce. • skizzieren die Abbildung von Pig-Latin-Programmen auf MapReduce. • schildern die grundsätzliche Funktionsweise von Systemen zur Kühlung von Datenzentren mittels Umgebungsluft. • beschreiben das Grundkonzept einer temperaturabhängigen Lastverteilung von Prozessen in einem Datenzentrum. • stellen diverse Ansätze zur Erhöhung der Energieeffizienz von MapReduce-Clustern gegenüber. • unterscheiden die Architekturen und Funktionsweisen der Koordinierungsdienste Chubby und ZooKeeper. • entwickeln einen eigenen Koordinierungsdienst nach dem Vorbild von ZooKeeper. • ermitteln die Konsistenzeigenschaften der eigenen Koordinierungsdienstimplementierung. • erschließen sich die mit der Implementierung passiv replizierter Systeme verbundenen Problematiken. • erläutern unterschiedliche Ansätze zur Reduzierung bzw. Tolerierung von Tail-Latenz. • skizzieren das Grundkonzept von Erasure-Codes. • beschreiben den Aufbau eines auf die Clouds mehrerer Anbieter gestützten Datenspeichersystems. • entwickeln einen Mechanismus zur Erkennung und Beseitigung von Überlastsituationen für virtuelle Maschinen in einer Infrastruktur-Cloud am Beispiel von Amazon EC2. • erläutern den Einsatz passiver Replikation zur Bereitstellung von Fehlertoleranzmechanismen für virtuelle Maschinen am Beispiel von Remus. • schildern die Grundlagen der Migration von virtuellen Maschinen. • unterscheiden zwischen Ausfalltoleranz und byzantinischer Fehlertoleranz. • bewerten die Qualität einer aktuellen Publikation aus der Fachliteratur. • erschließen sich typische Probleme (Nebenläufigkeit, Konsistenz, Skalierbarkeit) und Fehlerquellen bei der Programmierung verteilter Anwendungen. • können in Kleingruppen kooperativ arbeiten. • können ihre Entwurfs- und Implementierungsentscheidungen kompakt präsentieren und argumentativ vertreten. • reflektieren ihre Entscheidungen kritisch und leiten Alternativen ab. • können offen und konstruktiv mit Schwachpunkten und Irrwegen umgehen.
6	Empfohlene Voraussetzungen für die Teilnahme	Gute Programmierkenntnisse in Java
7	Einpassung in Musterstudienplan	Ab 1. Semester
8	Verwendbarkeit des Moduls	Master International Information Systems (from 2018/19): Module in the section Informatics – Data & Knowledge (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective)
9	Studien- und Prüfungsleistungen	Erfolgreiche Bearbeitung aller Übungsaufgaben (Bewertung jeweils mit "ausreichend") und ca. 20-minütige mündliche Prüfung.
10	Berechnung Modulnote	Mündliche Prüfung (100%)
11	Turnus des Angebots	Jährlich (WS)
12	Arbeitsaufwand	Präsenzzeit: 60 Std, Eigenstudium: 90 Std.
13	Dauer des Moduls	1 Semester

14	Unterrichts- und Prüfungssprache	Deutsch
15	(Vorbereitende) Literatur	• Mache Creeger. Cloud computing: An overview. Queue Distributed Computing, 7(5), 2009. • Michael Armbrust, Armando Fox, Rean Griffith, Anthony D. Joseph, Randy Katz, Andy Konwinski, Gunho Lee, David Patterson, Ariel Rabkin, Ion Stoica, and Matei Zaharia. Above the clouds: A Berkeley view of cloud computing. Technical Report UCB/EECS-2009-28, EECS Department, University of California, Berkeley, 2009. • Michael Armbrust, Armando Fox, Rean Griffith, Anthony D. Joseph, Randy Katz, Andy Konwinski, Gunho Lee, David Patterson, Ariel Rabkin, Ion Stoica, and Matei Zaharia. A view of cloud computing. Communications of the ACM, 53(4):5058, 2010.

Pattern recognition (PR)

1	Module name MSC 44130	Pattern recognition	5 ECTS
2	Courses/lectures	Lecture: Pattern recognition (3 SWS) Exercise: Pattern recognition (1 SWS)	
3	Lecturers	Elmar Nöth, Sebastian Käppler	

4	Module coordinator	Andreas Maier
5	Contents	Mathematical foundations of machine learning based on the following classification methods: • Bayesian classifier • Logistic Regression • Naive Bayes classifier • Discriminant Analysis • norms and norm dependent linear regression • Rosenblatt's Perceptron • unconstraint and constraint optimization • Support Vector Machines (SVM) • kernel methods • Expectation Maximization (EM) Algorithm and Gaussian Mixture Models (GMMs) • Independent Component Analysis (ICA) • Model Assessment • AdaBoost
6	Learning objectives and skills	Students understand the structure of machine learning systems for simple patterns, explain the mathematical foundations of selected machine learning techniques, apply classification techniques in order to solve given classification tasks, evaluate various classifiers with respect to their suitability to solve the given problem
7	Recommended prerequisites	Well grounded in probability calculus, linear algebra/matrix calculus The attendance of our bachelor course 'Introduction to Pattern Recognition' is not required but certainly helpful.
8	Integration in curriculum	3. semester
9 10	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Data & Knowledge (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective) Master Marketing: Wahlpflichtbereich der Modulgruppe „Data Science“ Master Marketing: Wahlpflichtbereich der Modulgruppe „Methoden“ (gültig für Studierende mit Studienbeginn bis WS 2016/17)
11	Method of examination	Oral examination (30 min)
12	Grading procedure	100% of the exam grade
13	Module frequency	Each winter semester
14	Workload	Contact hours: 60 h and independent study: 90 h
15	Module duration	1 Semester
16	Teaching and examination language	English
17	(Recommended) reading	Richard O. Duda, Peter E. Hart, David G. Stock: Pattern Classification, 2nd edition, John Wiley&Sons, New York, 2001 Trevor Hastie, Robert Tibshirani, Jerome Friedman: The Elements of Statistical Learning - Data Mining, Inference, and Prediction, 2nd edition, Springer, New York, 2009 Christopher M. Bishop: Pattern Recognition and Machine Learning, Springer, New York, 2006

Pattern analysis (PA)

1	Module name	Pattern recognition	5 ECTS
2	Courses/lectures MSC 44120	Lecture: Pattern analysis (3 SWS) Exercise: Pattern analysis (1 SWS)	
3	Lecturers	Christian Riess	

4	Module coordinator	Andreas Maier
5	Contents	Based on the lecture Pattern Recognition, this lecture introduces the design of pattern analysis systems as well as the corresponding fundamental mathematical methods. The lecture comprises: • an overview over regression and classification, in particular the method of least squares and the Bayes classifier • clustering methods: soft and hard clustering • classification and regression trees and forests • parametric and non-parametric density estimation: maximum-likelihood (ML) estimation, maximum-a-posteriori (MAP) estimation, histograms, Parzen estimation, relationship between folded histograms and Parzen estimation, adaptive binning with regression trees • mean shift algorithm: local maximization using gradient ascent for non-parametric probability density functions, application of the mean shift algorithm for clustering, color quantization, object tracking • linear and non-linear manifold learning: curse of dimensionality, various dimensionality reduction methods: principal component analysis (PCA), local linear embedding (LLE), multidimensional scaling (MDS), isomaps, Laplacian eigenmaps • Gaussian mixture models (GMM) and hidden Markov models (HMM): expectation maximization algorithm, parameter estimation, computation of the optimal sequence of states/Viterbi algorithm, forward-backward algorithm, scaling • Bayesian networks • Markov random fields (MRF): definition, probabilities on undirected graphs, Hammersley-Clifford theorem, cliques, clique potentials, examples for MRF-based image pre-processing and processing of image sequences • Markov random fields and graph cuts: sub-modular functions, global optimization with graph cut algorithms, application examples
6	Learning objectives and skills	The students • explain the discussed methods for classification, prediction, and analysis of patterns, • define regression and classification tasks as optimization problems, • compare and analyze methods for manifold learning and select a suited method for a given set of features and a given problem, • compare and analyze methods for probability density estimation and select a suited method for a given set of features and a given problem, • apply non-parametric probability density estimation to pattern analysis problems, • apply dimensionality reduction techniques to high-dimensional feature spaces, • explain statistic modeling of feature sets and sequences of features, • explain statistic modeling of statistical dependencies, • implement presented methods in MatLab or Python, • supplement autonomously the mathematical foundations of the presented methods by self-guided study of the literature, • discuss the social impact of applications of pattern analysis solutions.
7	Recommended prerequisites	Pattern Recognition
8	Integration in curriculum	4. semester
9 10	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Data & Knowledge (Elective)

		Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective)
11	Method of examination	Oral examination (30 min)
12	Grading procedure	100% of the exam grade
13	Module frequency	Each summer semester
14	Workload	Contact hours: 60 h and independent study: 90 h
15	Module duration	1 Semester
16	Teaching and examination language	English
17	(Recommended) reading	Richard O. Duda, Peter E. Hart und David G. Stork: Pattern Classification, Second Edition, 2004 Christopher Bishop: Pattern Recognition and Machine Learning, Springer Verlag, Heidelberg, 2006 Antonio Criminisi and J. Shotton: Decision Forests for Computer Vision and Medical Image Analysis, Springer, 2013 Kevin P. Murphy: Machine Learning: A Probabilistic Perspective, MIT Press, 2012 papers referenced in the lecture

Künstliche Intelligenz I (KI I)

1	Modulbezeichnung 535405	Künstliche Intelligenz I (Artificial intelligence I)	7.5 ECTS
2	Lehrveranstaltungen	Künstliche Intelligenz I – Vorlesung (4 SWS) Künstliche Intelligenz I – Übung (2 SWS)	7.5 ECTS
3	Lehrende	Prof. Dr. Michael Kohlhase	

4	Modulverantwortliche/r	Prof. Dr. Michael Kohlhase
5	Inhalt	Dieser Kurs beschäftigt sich mit den Grundlagen der Künstlichen Intelligenz (KI), insbesondere formale Wissensrepräsentation, Heuristische Suche, Automatisches Planen und Schliessen unter Unsicherheit.
6	Lernziele und Kompetenzen	Fach- Lern- bzw. Methodenkompetenz • Wissen: Die Studierenden lernen grundlegende Repräsentationsformalismen und Algorithmen der Künstlichen Intelligenz kennen. • Anwenden: Die Konzepte werden an Beispielen aus der realen Welt angewandt (Übungsaufgaben). • Analyse: Die Studierenden lernen die über die modellierung in der Maschine menschliche Intelligenzleistungen besser einzuschätzen. Sozialkompetenz • Die Studierenden arbeiten in Kleingruppen zusammen um kleine Projekte zu bewältigen
7	Empfohlene Voraussetzungen für die Teilnahme	/
8	Einpassung in Musterstudienplan	3. Semester
9	Verwendbarkeit des Moduls	Master International Information Systems (from 2018/19): Module in the section Informatics – Data & Knowledge (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective) Studierende müssen KI I und KI II absolvieren, ansonsten kann das Modul nicht verbucht werden!
10	Studien- und Prüfungsleistungen	Klausur (90 Minuten) (Written examination: 90 minutes)
11	Berechnung Modulnote	100% der Klausurnote (Bonuspunkte durch Übungsaufgaben)
12	Turnus des Angebots	Winter Semester
13	Arbeitsaufwand	Präsenzzeit: 90 Std. Eigenstudium: 135 Std.
14	Dauer des Moduls	1 Semester
15	Unterrichts- und Prüfungssprache	Deutsch und Englisch
16	(Vorbereitende) Literatur	Stuart Russell und Peter Norvig: Artificial Intelligence: A Modern Approach. Prentice Hall, 3rd edition, 2009.

Künstliche Intelligenz II (KI II)

1	Module name	Artificial intelligence II	7.5 ECTS
2	Courses/lectures	Lecture: Artificial intelligence II (4 SWS) Exercise: Artificial intelligence II (2 SWS)	7.5 ECTS
3	Lecturers	Prof. Dr. Michael Kohlhase	

4	Module coordinator	Prof. Dr. Michael Kohlhase
5	Contents	This course covers the foundations of Artificial Intelligence (AI), in particular reasoning under uncertainty, machine learning and (if there is time) natural language understanding. This course builds on the course Artificial Intelligence I from the preceding winter semester and continues it.
6	Learning objectives and skills	Technical, Learning, and Method Competencies: - Knowledge: The students learn foundational representations and algorithms in AI. - Application: The concepts learned are applied to examples from the real world (homeworks). - Analysis: By modeling human cognitive abilities, students learn to assess and understand human intelligence better. Social Competencies: - Students work in small groups to solve the machine learning challenge/competition.
7	Recommended prerequisites	Course Artificial intelligence I
8	Integration in curriculum	2./4. Semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Data & Knowledge (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective) Students must complete both KI I and KI II, otherwise the module cannot be credited!
10	Method of examination	Written examination (90 minutes)
11	Grading procedure	Exam (100%)
12	Module frequency	Each summer term
13	Workload	Class: 90h Self-study: 135h
14	Module duration	1 semester
15	Teaching and examination language	German or English
16	(Recommended) reading	The course follows the following textbook: Stuart Russell and Peter Norvig: Artificial Intelligence: A Modern Approach. Prentice Hall, 3rd edition, 2009.

Applied visualization (AppVis)

1	Module name	Applied visualization	5 ECTS
2	Courses/lectures	Vorlesung: Applied visualization (2 SWS) Übung: Applied visualization (2 SWS)	
3	Lecturers	Dr. Grosso	
4	Module coordinator	Dr. Grosso	
5	Contents	Visualization includes all aspects related to the visual preparation of usually large data sets from technical or scientific experiments and simulation. For a better understanding and a meaningful representation of complex phenomena, methods from interactive computer graphics are applied. This lecture introduces basic algorithms and data structures and gives an overview of available software tools and common data formats. The lecture covers the following topics: • scenarios for visualization • meshes and data representation • methods for 2D scalar and vector fields • methods for 3D scalar and vector fields • methods for multivariate data • volume rendering with iso-surfaces direct volume rendering	
6	Learning objectives and skills	Students • have a deep understanding of the process of visual processing of large data sets from scientific experiments and simulations • can explain and apply fundamentals algorithm and data structures of scientific visualization to common practical problems • are familiar with standard software tools in the area of scientific data visualization • can carry out simple research projects requiring methods for the visualization of scientific data are able to implement simple algorithms for the visualization of scientific data from common science and engineering applications	
7	Recommended prerequisites	Algorithmen und Datenstrukturen	
8	Integration in curriculum	2. oder 4. Semester	
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Data & Knowledge (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective)	
10	Method of examination	Written examination (90 Min.) (Klausur, 90 Minuten)	
11	Grading procedure	100% of exam score	
12	Module frequency	Each summer term	
13	Workload	Class: 60h Self-study: 90h	
14	Module duration	1 Semester	
15	Teaching and examination language	English	
16	(Recommended) reading	M. Ward, G.G. Grinstein, D. Keim, Interactive Data Visualization: Foundations, Techniques, and Applications, Taylor & Francis, 2010 AC. Telea, Data Visualization: Principles and Practice, AK Peters, 2008 C.D. Hansen and C.R. Johnson, Visualization Handbook, Academic Press, 2004	

		G.M. Nielson, H. Hagen, H.Müller, Scientific Visualization, IEEE Computer Society Press, Los Alamitos, 1997
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Deep Learning (DL)

17	Module name UMI 901895	Deep learning	5 ECTS
18	Courses/lectures	Vorlesung: Deep Learning (2 SWS) Übung: Deep Learning Exercises (2 SWS)	
19	Lecturers	Andreas Maier, Tobias Würfl, Vincent Christlein, Lennart Husvagt	
20	Module coordinator	Andreas Maier	
21	Contents	Deep Learning (DL) has attracted much interest in a wide range of applications such as image recognition, speech recognition and artificial intelligence, both from academia and industry. This lecture introduces the core elements of neural networks and deep learning, it comprises: • (multilayer) perceptron, backpropagation, fully connected neural networks • loss functions and optimization strategies • convolutional neural networks (CNNs) • activation functions • regularization strategies • common practices for training and evaluating neural networks • visualization of networks and results • common architectures, such as LeNet, Alexnet, VGG, GoogleNet • recurrent neural networks (RNN, TBPTT, LSTM, GRU) • deep reinforcement learning • unsupervised learning (autoencoder, RBM, DBM, VAE) • generative adversarial networks (GANs) • weakly supervised learning • applications of deep learning (segmentation, object detection, speech recognition, ...) The accompanying exercises will provide a deeper understanding of the workings and architecture of neural networks.	
22	Learning objectives and skills	Students • explain the different neural network components, • compare and analyze methods for optimization and regularization of neural networks, • compare and analyze different CNN architectures, • explain deep learning techniques for unsupervised / semi-supervised and weakly supervised learning, • explain deep reinforcement learning, • explain different deep learning applications, • implement the presented methods in Python, • autonomously design deep learning techniques and prototypically implement them, • effectively investigate raw data, intermediate results and results of Deep Learning techniques on a computer, • autonomously supplement the mathematical foundations of the presented methods by self-guided study of the literature, • discuss the social impact of applications of deep learning applications.	

23	Recommended prerequisites	Introduction to Pattern Recognition
24	Integration in curriculum	From 2. Semester
25	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Data & Knowledge (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective) Master Marketing: Wahlpflichtbereich der Modulgruppe „Data Science“ Master Marketing: Wahlpflichtbereich der Modulgruppe „Methoden“ (gültig für Studierende mit Studienbeginn bis WS 2016/17)
26	Method of examination	Oral examination (30 Min.) (mündl. Prüfung, 30 Minuten)
27	Grading procedure	100% of exam score
28	Module frequency	Each term (SS + WS)
29	Workload	Class: 60h Self-study: 90h
30	Module duration	1 Semester
31	Teaching and examination language	English or German
32	(Recommended) reading	Ian Goodfellow, Yoshua Bengio, Aaron Courville: Deep Learning. MIT Press, 2016. Christopher Bishop: Pattern Recognition and Machine Learning, Springer Verlag, Heidelberg, 2006 Yann LeCun, Yoshua Bengio, Geoffrey Hinton: Deep learning. Nature 521, 436–444 (28 May 2015)

Software-Anwendungen mit KI (OSS-SAKI-VUE)

33	Module name	Software-Anwendungen mit KI	5 ECTS
34	Courses/lectures	Vorlesung: Software-Anwendungen mit KI (2 SWS) Übung: Software-Anwendungen mit KI (2 SWS)	
35	Lecturers	Dirk Riehle	
36	Module coordinator	Dirk Riehle	
37	Contents	Dieser Kurs lehrt fortgeschrittene Methoden des maschinellen Lernens resp. der künstlichen Intelligenz anhand von vier nicht-trivialen Anwendungsbeispielen mit realen Daten aus der Industrie. Jedes der vier Beispiele stellt eine umfangreiche Hausaufgabe für Studierende dar, in der unterschiedliche Problemarten (Korrelation, Klassifikation, etc.) mit unterschiedlichen Methoden (Clustering, Bayesian Networks, etc.) in unterschiedlichen Fachgebieten (Automobilindustrie, Finanzindustrie, etc.) kombiniert werden. Jede Aufgabe wird von einem dazugehörigen Industriepartner mitbetreut. Die vier Beispiele werden nacheinander abgearbeitet und strukturieren die Kurszeit in vier gleich große Abschnitte von jeweils drei Wochen, von denen jeder Abschnitt dieselbe Struktur hat: Vorbereitung auf den anstehenden Abschnitt durch Wiederholung relevanter Literatur Einführung in das Problem; Diskussion von Bibliotheken und Vorgehen zur Problemlösung Wiederholte Diskussion (zwei weitere Sitzungen) des Problems und der Herangehensweise Abgabe der Problemlösung, bestehend aus Erläuterung sowie Quelltext und Ergebnissen Die Programmierung findet in Python statt. Es wird erwartet, dass Studierende aktiv mitarbeiten, sich etwaige fehlende Grundlagen selbst aneignen, und die technischen Aufgaben eigenständig lösen werden. Der Zeitplan ist unter https://goo.gl/5ynxcQ einsehbar. Bitte registrieren Sie sich für den Kurs auf StudOn (Verweis über Zeitplan verfügbar).	
38	Learning objectives and skills	Erwerb praktischer Kompetenz in der Anwendung von ML und KI-Methoden auf reale industrielle Daten	
39	Recommended prerequisites	Grundlagenveranstaltungen in maschinellem Lernen und künstlicher Intelligenz	
40	Integration in curriculum	Ab dem 2. Semester	
41	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Data & Knowledge (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective)	
42	Method of examination	Portfolio	
43	Grading procedure	Portfolio (100%)	

44	Module frequency	Jedes Sommersemester
45	Workload	Präsenzzeit: 60h Eigenstudium: 90h
46	Module duration	1 Semester
47	Teaching and examination language	Deutsch
48	(Recommended) reading	-

Commercial Open Source Startups (VUE) (OSS-COSS-VUE)

1	Module name 93184	Commercial open source startups (VUE) (OSS-COSS-VUE)	5 ECTS
2	Courses/lectures	Commercial open source startups (VUE) (OSS-COSS-VUE)	5 ECTS
3	Lecturers	Prof. Riehle, M.B.A.	

4	Module coordinator	Prof. Riehle
5	Contents	This course teaches students how the software industry works, how commercial open source works, and how to spin-off from the university. It consists of four main components: • The software industry • Commercial open source • Open source projects • University spin-offs Class is run as two 90min blocks, one for the lecture, and one for the exercises. Schedule and sign-up are available at https://oss.cs.fau.de/oss-coss-course. Please sign up for the course on StudOn (available through previous link) as soon as possible.
6	Learning objectives and skills	- Understand the software industry and its players - Understand commercial open source startups - Learn how to get an open source project off the ground - Learn how to spin-off a startup from university
7	Recommended prerequisites	None
8	Integration in curriculum	• Informatik-Master and Wirtschaftsinformatik-Master (IIS): All semesters • Other Master degree programs
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Digital Business (Core Course or Elective) Master International Information Systems (from 2016/17): Module in the section Informatics – Applied Software Engineering I or II (Core Course or Elective)
10	Method of examination	Portfolio (Class quizzes: 10%, Project work: 10% (Graded by deliverables, see course slides), Project presentation: 10%, Final project report: 20%, Oral exam: 50% (Can be dropped, if you and we agree))

11	Grading procedure	Portfolio (100%)
12	Module frequency	Each winter term
13	Workload	Contact hours: 60h Self-study: 90h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	See https://oss.cs.fau.de/oss-coss-course

Human computer interaction (HCI)

1	Module name 645618	Human computer interaction	5 ECTS
2	Courses/lectures	Vorlesung: Human computer interaction (3 SWS) Übung: Human computer interaction (1 SWS)	
3	Lecturers	Björn Eskofier	
4	Module coordinator	Björn Eskofier	
5	Contents	Aim of the lecture is to teach basic knowledge of concepts, principles, models, methods and techniques for developing highly user-friendly Human Computer Interfaces. Beyond traditional computer system the topic of modern user interfaces is also discussed in the context of automobile and intelligent environments, mobile devices and embedded systems. This lecture addresses the following topics: • Introduction to the basics of Human Computer Interaction • Design principles and models for modern user interfaces and interactive systems • Information processing of humans, perception, motor skills, properties and skills of the users • Interaction concepts, metaphors, standards, norms and style guides • In- and output devices, design space for interactive systems • Analysis-, design- and development methodologies and tools for easy to use user interfaces • Prototypic implementation of interactive systems • Architectures for interactive systems, User Interface Toolkits and components • Acceptance, evaluation methods and quality assurance	
6	Learning objectives and skills	Students develop an understanding for models, methods and concepts in the field of Human-Computer Interaction. They learn different approaches for designing, developing and evaluating User Interfaces and their advantages and disadvantages. Joining the course enables students to understand and execute a development process in the area of Human-Computer Interaction. Student will be able to do an UI evaluation by learning basics about Information processing, perception and motoric skills of the user. Additionally, appropriate evaluation method as well as acceptance and quality assurance aspects will be learned.	
7	Recommended prerequisites	None	
8	Integration in curriculum	2. or 4. Semester	
9 10	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Digital Business (Core Course or Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective)	
11	Method of examination	Written exam (90 minutes)	
12	Grading procedure	100% of exam grade	
13	Module frequency	Each summer semester	
14	Workload	Contact hours: 60 h Independent study: 90 h	
15	Module duration	1 Semester	
16	Teaching and examination language	German or English	
17	(Recommended) reading	None	

The AMOS project (PSWT-AMOS)

1	Module name MSC 71921 + MSC 71931	The AMOS project (PSWT-AMOS)	5 ECTS or 10 ECTS
2	Courses/lectures	Lecture and exercise: The AMOS project (2 + 2 SWS) (PSWT-AMOS)	5 ECTS or 10 ECTS
3	Lecturers	Prof. Riehle, M.B.A.	

4	Module coordinator	Prof. Riehle
5	Contents	The AMOS Project teaches agile methods (Scrum and XP) and open source software development using a single semester-long project. Topics covered are: • Agile methods and related software development processes • Scrum roles, process practices, including product and engineering management • Technical practices like refactoring, continuous integration, and test-driven development • Principles and best practices of open source software development The project is a software development project in which student teams work with an industry partner who provides the idea for the project. This is a practical hands-on experience. Students can play one of two primary roles: • Product owner. In this function, a student defines, prioritizes, communicates, and reviews requirements. The total effort adds up to 5 ECTS. • Software developer. In this function, a student estimates their effort for requirements and implements them. The total effort adds up to 10 ECTS. Students will be organized into teams of 5-7 people, combining product owners with software developers. An industry partner will provide requirements to be worked out in detail by the product owners and to be realized by the software developers. The available projects will be presented at the beginning of the course. AMOS projects are run as shared projects, in which all participants contribute and get to participate in the project results. Read more at https://wp.me/pDU66-2p4. Class is run as a 4 hour block with a 90min lecture followed by a guided 90min project coaching session. Rooms and times for project meetings are assigned in the beginning of the semester. For the schedule see http://goo.gl/BZpU8. The schedule spreadsheet contains a link to the StudOn course section. To get a chance for a seat in the course, please sign-up on StudOn at least two weeks before classes start. We expect to inform you the week before whether you got a seat in the course or not.
6	Learning objectives and skills	- Understanding of software products and software development in an industry context - Understanding of agile methods, in particular Scrum and Extreme Programming - Understanding of open source software development and its underlying principles - Practical hands-on experience with a Scrum process and XP technical practices
7	Recommended prerequisites	- General: PSWT-PSWT - Product owner role: OSS-PROD - Software developer role: OSS-ADAP

8	Integration in curriculum	- Informatik-Master and Wirtschaftsinformatik-Master (IIS): All semesters - Other Master degree programs
9	Module compatibility	- 5 ECTS Lecture + Exercises (product owner role): Master International Information Systems (from 2018/19): Module in the section Informatics – Digital Business (Elective) Master in International Information Systems (from 2016/17): Module in the section In-formatics – Applied Software Engineering I or II (Core Course or Elective) - 10 ECTS Lecture + Exercise (developer role): Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Elective) Master in International Information Systems (from 2016/17): Module in the section Informatics – Applied Software Engineering II (Elective)
10	Method of examination	- In-class participation - Project work
11	Grading procedure	- 5 ECTS version: Class work (20%) + project work (80%) - 10 ECTS version. 5 ECTS version (50%) + project work (50%)
12	Module frequency	Irregular
13	Workload	- 5 ECTS version: 60h in class + 90h project work - 10 ECTS version. ECTS version + 150h project work
14	Module duration	1 semester
15	Teaching and examination language	English, occasionally German
16	(Recommended) reading	See http://goo.gl/BZpU8

Innovationslabor für Wearable und Ubiquitous Computing (InnoLab)

1	Module name 615628	Innovationslabor für Wearable und Ubiquitous Computing (Innovation lab for wearable and ubiquitous computing)	10 ECTS
2	Courses/lectures	Praktikum: Innovationslabor für Wearable und Ubiquitous Computing (InnoLab)	10 ECTS
3	Lecturers	Björn Eskofier, Markus Zrenner, Nils Roth	

4	Module coordinator	Prof. Eskofier
5	Contents	Mini-computers documenting our rhythm of life, EKG-Sensors tracing every detail or glasses, that transfer us into another reality are amongst the technologies we are meanwhile facing in our everyday lives. At the Innovation Lab for Wearable and Ubiquitous Computing students develop such technologies and learn about the possibilities and requirements to build a start-up. The Lab is funded by the Center of Digitalization Bavaria (ZD.B). By applying agile development methods (Scrum), teams of 5 to 8 students develop prototypes of products within the wearable and ubiquitous computing field. Participating students have open access to the Innovation Lab, which provides them with everything they need to develop their prototypes. The project ideas originate from cooperating companies or the students themselves. Besides the great practical experience gained during development, students also learn about entrepreneurship. There will be tutorials covering design thinking, market analysis, management of development processes, securing intellectual property, and business plan creation.
6	Learning objectives and skills	• Ideation, Design Thinking • Patent Research, Markt Analysis • Agile Development Methods (Scrum) • Prototyping • Securing Intellectual Property • Introduction to Entrepreneurship, Startup Financing
7	Recommended prerequisites	Topic assignment and finding appointments take place in the first week of the semester. Registration until October 15th via StudOn. Seminar places by first come, first serve, the order of the registration is decisive. Afterwards, there is a waiting list. The course can also be attended by students of the mentioned fields (Bachelor 5th semester or higher, all Master students). For other study programs or information to ECTS distributions, please contact Matthias Zürl (Matthias.Zuerl@fau.de). More information to course can be found at our website: https://www.mad.tf.fau.de/research/projects/innovation-lab-for-wearable-and-ubiquitous-computing
1	Integration in curriculum	Second semester
2	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Digital Business (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective)
10	Method of examination	Presentation (50%), Practical work (50%)
11	Grading procedure	Presentation (50%), Practical work (50%)
12	Module frequency	Each summer and winter term
13	Workload	Contact hours: 60 h + Independent study: 90 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	All relevant material will be provided during the lecture.

Datenschutz, Compliance und Elektronische Signaturen (DSES)

1	Modulbezeichnung 829281	Datenschutz, Compliance und Elektronische Signaturen	5 ECTS
2	Lehrveranstaltungen	V: Datenschutz und Compliance (2 SWS) V: Electronic signatures (ES) (2 SWS)	2,5 ECTS 2,5 ECTS
3	Lehrende	Prof. Tielemann (DATEV, Lehrbeauftragter)	

4	Modulverantwortliche/r	Prof. Tielemann
5	Inhalt	DS: Die Vorlesung führt in die Grundlagen der EU Grundsatzverordnung ein. Es werden datenschutzrelevanter Begriffe erklärt, gesellschaftliche Reflexion zum Datenschutz und Datenhandel gemeinsam erarbeitet und weitere Datenschutzregelungen gesichtet. Ziel der VL ist es, Problembewusstsein zum Thema Datenschutz zu ermöglichen und Maßnahmen zur Verbesserung des Datenschutzniveaus zu erarbeiten. Alle Teilnehmer sind aufgerufen sich in der VL an einer gesellschaftspolitischen Diskussion zum Thema Datenschutz zu beteiligen. Der Begriff Compliance umfasst weitläufig das gesetzeskonforme Verhalten im Alltag, insbesondere auch bei dem Betrieb von IT-Systemen. Es werden die Disziplinen eines Compliance-Frameworks vorgestellt und einzelne Themen (z. B. die Risikoanalyse) vertieft. ES: Die Vorlesung gibt einen Überblick über die relevanten gesetzlichen Regelungen wie die Verordnung (EU) Nr. 910/2014 über elektronische Identifizierung und Vertrauensdienste für elektronische Transaktionen im Binnenmarkt (EIDAS). Eine Reihe technischer Interpretationen der gesetzlichen Vorgaben werden vorgestellt. Dies sind u. a. Signaturerstellungseinheit (Smart Card), Zertifikatsproduktion, Trustcenter, Registrierungs- und Auslieferungsprozesse, Signatursicherheitsniveaus sowie Zertifikatsauskunfts- und Zeitstempelsysteme. Es werden vertrauensbildende Maßnahmen und Evaluierungsmethoden bei der SW-Erstellung wie ITSEC und Common Criteria im Zertifizierungsprozess besprochen. Neben beispielhaften Anwendungen der elektronischen Signatur- und Zeitstempelkomponenten werden eine Einführung in relevante Standards (IETF, CEN) und aktuelle Problemstellungen (z. B. E-Government, elektronischer Rechtsverkehr, virtuelle Poststelle, beweissichere Archivierung) gegeben.
	Lernziele und Kompetenzen	Die Teilnehmer - erwerben aktuelles und grundlegendes Verständnis - lernen die gesetzlichen und technischen Randbedingungen kennen - reflektieren Aufwand, Komplexität und Nutzen von elektronischen Signaturen.
6	Empfohlene Voraussetzungen für die Teilnahme	Grundlagen von Datenbanksystemen – im Umfang der Module KonzMod und DBS im Bachelorstudium Informatik oder des Moduls DBNF in anderen Studiengängen
7	Einpassung in Musterstudienplan	Master Informatik: Beginn im zweiten und Abschluss/Prüfung im dritten Fachsemester Master International Information Systems: Beginn im zweiten und Abschluss/Prüfung im dritten Fachsemester

8	Verwendbarkeit des Moduls	eine Hälfte des Wahlpflichtmoduls "Informatik II" oder "Informatik III" im Master-Studiengang Informatik (über zwei Semester) eine Hälfte des Wahlpflichtmoduls "Informatik IV" im Master-Studiengang Informatik (über zwei Semester) Wahlpflichtmodul "Informatik VII" im Master-Studiengang Informatik (über zwei Semester) Wahlpflichtmodul "Informatik VIII" im Master-Studiengang Informatik (über zwei Semester) Wahlpflichtmodul "Vertiefung Datenbanksysteme A" Master International Information Systems (from 2018/19): Module in the section Informatics – Digital Business (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective)
9	Studien- und Prüfungsleistungen	DS: schriftliche Klausur (60 Minuten) ES: schriftliche Klausur (60 Minuten)
10	Berechnung Modulnote	DS (50%) und ES (50%)
11	Turnus des Angebots	Jährlich, im Sommersemester (DS) und im anschließenden Wintersemester (ES)
12	Arbeitsaufwand	Präsenzzeit: 54 Eigenstudium: 96 d.h. je Vorlesung ca. 1h pro Woche Nachbereitung im laufenden Semester und ca. 60h Prüfungsvorbereitung in der vorlesungsfreien Zeit; erfolgt keine begleitende Nachbereitung sind ca. 90h für die Prüfungsvorbereitung einzukalkulieren
13	Dauer des Moduls	Zwei Semester, beginnend im Sommersemester mit DS
14	Unterrichts- und Prüfungssprache	Deutsch
15	(Vorbereitende) Literatur	Keine

Einführung in die IT-Sicherheit (EinfITSec + Ü)

1	Modulbezeichnung MSC 46311	Einführung in die IT-Sicherheit Introduction to IT security	5 ECTS
2	Lehrveranstaltungen	V: Angewandte IT-Sicherheit Ü: Einführung in die IT-Sicherheit (2+2)	5 ECTS
3	Lehrende	Prof. Freiling	

4	Modulverantwortliche/r	Prof. Freiling
5	Inhalt	Die Vorlesung gibt einen einführenden Überblick über Konzepte und Methoden der IT-Sicherheit und eignet sich als Einstieg in das Vertiefungsgebiet "IT-Sicherheit" an der FAU. Themen (unter anderem): IT-Sicherheit vs. physische Sicherheit, Identifizierung und Authentifizierung, grundlegende Muster von Unsicherheit in technischen Systemen, grundlegende Abwehrmechanismen, ausgewählte Beispiele aus dem Bereich Systemsicherheit, Netzwerksicherheit und Softwaresicherheit. In der Übung werden die Themen der Veranstaltung beispielhaft eingeübt. Themen (unter anderem): "lock picking", "social engineering", ausnutzen von Softwareschwachstellen
6	Lernziele und Kompetenzen	Teilnehmer erwerben einen Überblick über Konzepte und Methoden aus dem Bereich der IT-Sicherheit und können diese im Kontext der Informatik und der Lebenswirklichkeit anhand von Beispielen einordnen und erläutern. Die Studierenden können die wichtigsten Arten von Softwareschwachstellen in Programmen erkennen und benennen. Sie können außerdem erläutern, wie man diese Schwachstellen ausnutzt und welche technischen und organisatorischen Maßnahmen geeignet sind, diese Schwachstellen zu vermeiden. Die Studierenden lernen, die Wirksamkeit von IT-Sicherheitsmechanismen im gesellschaftlichen Kontext und in Kenntnis professioneller Strukturen der Cyberkriminalität aus technischen, ethischen und rechtlichen Perspektiven zu bewerten.
7	Empfohlene Voraussetzungen für die Teilnahme	Keine
8	Einpassung in Musterstudienplan	Drittes Semester
9	Verwendbarkeit des Moduls	Master International Information Systems (from 2018/19): Module in the section Informatics – Digital Business (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective)
10	Studien- und Prüfungsleistungen	Klausur (60 Minuten)
11	Berechnung Modulnote	Klausur (100%)
12	Turnus des Angebots	jährlich im Wintersemester
13	Arbeitsaufwand	Präsenzzeit: 60 h Eigenstudium: 90 h
14	Dauer des Moduls	1 Semester
15	Unterrichts- und Prüfungssprache	Deutsch
16	(Vorbereitende) Literatur	Dieter Gollmann: Computer Security. 3. Auflage, Wiley, 2010. Joachim Biskup: Security in Computing Systems. Springer, 2008. Weitere Literatur wird in der Vorlesung bekanntgegeben

Human factors in security and privacy (HumSecPri + Ü)

1	Module name 658644	Human factors in security and privacy	5 ECTS
2	Courses/lectures	Vorlesung: Human factors in security and privacy Übung: Human factors in security and privacy	2,5 ECTS 2,5 ECTS
3	Lecturers	Dr. Benenson	

4	Module coordinator	Dr. Benenson
5	Contents	This course provides insights into how security and privacy measures can fail to protect the users, and why this happens. Special attention is paid to complex environments such as companies, governmental organizations or hospitals. A number of guest talks from practitioners and researchers highlight some of the issues in greater depth. The course covers the following topics: • Terminology of security and privacy, technical and non-technical protection measures • Development and testing of usable security mechanisms (encryption and authentication tools, security policies, security warnings) • Risk perception and decision making in security and privacy context (usage of security software, reaction to security warnings, divulging information in social media) • Economics approach to security and privacy decision making (traditional and behavioral economics) • Trade-offs between the national security and surveillance (psychology behind the EU data retention directive and NSA programs) • Psychological principles of cyber fraud (scams, phishing, social engineering) • Security awareness and user education • Interplay of safety and security in complex systems • Research methods in human factors (qualitative vs. quantitative research, usability testing, experimental design, survey design, interviews) The exercises aim at deepening the understanding of the topics and are highly relevant for oral examinations. We plan to conduct approximately eight exercises per semester; the rest of the exercises is reserved for the guest talks. A typical exercise consist of two parts: (1) For each topic, the students receive a homework assignment consisting of practical exercises. (2) For each topic, the students receive 1-3 papers to read for the next exercise. The papers will be discussed in the class with the teaching assistant.
6	Learning objectives and skills	The main goal of this course is to develop a mindset that naturally takes into account typical psychological and physical characteristics of the users. When developing or evaluating security- and privacy-enhancing technologies or policies, the students are able to: • critically appraise technological solutions or policies for likely human factors issues in design and usage • choose appropriate techniques for evaluation • develop and test improvements More precisely, after the successful completion of the course the students are able to:

		• identify main research questions in the area of human factors in security and privacy • demonstrate specific difficulties in developing and testing of usable security mechanisms • compare different approaches to the development of usable security features • apply elements of user-centered design to development and evaluation of security- and privacy-enhancing techniques • contrast the approaches of traditional and behavioral economics to the explanation of security- and privacy-related behavior • illustrate the influence of the psychological risk perception principles (especially under- and overestimation of risk) on security and privacy decision making • argue advantages and disadvantages of mass surveillance and other kinds of mass data collection for security and privacy of citizens • explain main psychological principles behind the cyber fraud • illustrate specific difficulties in awareness campaigns and user training in the realms of security and privacy • critically appraise design and results of published user studies • plan and conduct small user studies • scan research papers and other materials for important points that clarify and deepen course contents • develop well-founded personal opinions on the course topics and defend them in the class discussions
7	Recommended prerequisites	Basic knowledge in the area of IT security and privacy, such as security goals (CIA), basic protection mechanisms (symmetric and asymmetric cryptography, digital certificates and signatures, SSL/TLS, authentication) is required. This knowledge can be acquired through the attendance of the module "Angewandte IT Sicherheit" or similar modules.
8	Integration in curriculum	Zweites Semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Digital Business (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective)
10	Method of examination	Klausur (90 Minuten)
11	Grading procedure	Klausur (100%)
12	Module frequency	jährlich im Sommersemester
13	Workload	Präsenzzeit: 60 h und Eigenstudium: 90 h
14	Module duration	1 Semester
15	Teaching and examination language	Deutsch (Vorlesungsfolien und Materialien auf Englisch, Übungsaufgaben auf Deutsch; Abgabe der Übungsaufgaben, Vortrag und Prüfung können auf Wunsch auf Englisch erfolgen)
16	(Recommended) reading	L. F. Cranor, S. Garfinkel. Security and usability: designing secure systems that people can use. O'Reilly Media, Inc., 2005. Schneier, Bruce. "Beyond fear." Copernicus Book, 2003. Anderson, Ross. Security engineering. 2 nd edition, John Wiley & Sons, 2008.

IT-Modernisierung

1	Modulbezeichnung 716516	IT-Modernisierung (IT modern)	5 ECTS
2	Lehrveranstaltungen	Vorlesung: IT-Modernisierung (4 SWS)	
3	Lehrende	PD Peter Wilke	

4	Modulverantwortliche/r	PD Peter Wilke
5	Inhalt	IT-Modernisierung beschäftigt sich mit dem Ersatz alter Software- und/oder Hardware. Software im kommerziellen Bereich hat eine typische Lebensdauer von über 25 Jahren, damit ist klar, dass diese keine der momentan oder zukünftig zur Verfügung stehenden Möglichkeiten nutzt oder nutzen kann, denn "damals" waren Single-CPUs der Standard und Vernetzung unbekannt. Durch das hohe Investitionsvolumen ist eine Neu-Programmierung praktisch immer wirtschaftlich nicht sinnvoll und technisch oft unmöglich, da gar nicht genügend Programmierer zur Verfügung stehen. Die Software hat aber einen hohen Reifegrad erreicht, so dass sich die Frage stellt, ob man diese nicht automatisiert auf neue Technologien umstellen kann. Dieses Modul beleuchtet nun exemplarisch, auf welchen Feldern Bedarf besteht, wie der Stand der Technik ist, und welche zukünftigen Fragestellungen sich abzeichnen. Die Studierenden werden durch Übungsaufgaben mit den "alten" Programmiersprachen wie Cobol, Assembler, Fortran uä. vertraut gemacht, und bearbeiten selbstständig kleine Migrations-Aufgaben. Als Dozenten werden erfahrene Spezialisten aus der Industrie über ihre Fragestellungen und Ansätze berichten. Momentane Planung (Stand Juli 2016, Themen nicht zwingend in dieser Reihenfolge): • Einleitung • Überblick • Aufbau (Architektur) eines Rechenzentrums • DB2 unter z/OS • Exkursion DATEV Rechenzentrum • RZ Konsolidierung • Server Konsolidierung • Cobol Grundlagen, RD/z, TSO/ISPF, JCL • System z Hardware Grundlagen • Java am Host • Mainframe Programmierung • Legacy-Anwendungen in einer Cloud-Architektur, CICS Modernisierung • Internationalisierung: Unicode im Rechenzentrum • Praxisbericht IT-Betrieb (Aufgabenstellung) • Infrastrukturen-Modernisierung • Praxisbericht IT-Betrieb
6	Lernziele und Kompetenzen	/
7	Empfohlene Voraussetzungen für die Teilnahme	/
8	Einpassung in Musterstudienplan	2. oder 4. Semester

9 10	Verwendbarkeit des Moduls	Master International Information Systems (from 2018/19): Module in the section Informatics – Digital Business (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective)
11	Studien- und Prüfungsleistungen	Mündliche Prüfung (30 min)
12	Berechnung Modulnote	100% der Prüfungsnote
13	Turnus des Angebots	Jedes Sommersemester
14	Arbeitsaufwand	Präsenzzeit: 60h Eigenstudium: 90h
15	Dauer des Moduls	1 Semester
16	Unterrichts- und Prüfungssprache	Deutsch
17	(Vorbereitende) Literatur	/

Cryptocurrencies (CryptoCur)

1	Module name 566245	Cryptocurrencies	5 ECTS
2	Courses/lectures	Praktikum: Cryptocurrencies (4 SWS)	5 ECTS
3	Lecturers	Prof. Schröder	

4	Module coordinator	Prof. Schröder
5	Contents	• Cryptographic e-cash • Blockchain • Bitcoin Protocol • Nakamoto Consensus • Bitcoin Community and Politics • Alternative Mining Approaches • Alternative Coins: Ethereum, Anonymous Payments, Zero-Knowledge Cash... • Other state-of-the-art topic related to cryptocurrencies
6	Learning objectives and skills	Verstehen Die Studierenden kennen die wesentlichen Eigenschaften digitaler Währungen und können diese auch vergleichen. Analysieren Die Studierenden können digitale Währungen untersuchen und überprüfen, ob diese die grundlegenden Eigenschaften einer digitalen Währung erfüllen. Evaluiieren (Beurteilen) Die Studierenden können unterschiedliche digitalen Währung miteinander vergleichen und je nach Anwendung einen geeigneten Kandidaten ermitteln.
7	Recommended prerequisites	Only basic knowledge in cryptography or computer security is assumed. It would be ideal if you have done a cryptography and/or security class at FAU or during your previous studies somewhere else. Motivated students without this background are also welcome to the course. However, we would expect some more spirited efforts from you.
3	Integration in curriculum	Second semester
4	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Digital Business (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective)
10	Method of examination	Oral examination, 30 minutes (mündliche Prüfung, 30 Minuten)
11	Grading procedure	The grade consists to 35% of grades for exercise sheets and to 65% of the grade for a programming project (to be defined) developed by the end of the course (in groups of at most 3 students).
12	Module frequency	Each summer term
13	Workload	Contact hours: 60 h Independent study: 90 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	All relevant material will be provided during the lecture.

Foundations of Cryptocurrencies (FoundCrypt)

1	Module name 566245	Foundations of Cryptocurrencies	5 ECTS
2	Courses/lectures	Foundations of Cryptocurrencies (4 SWS)	5 ECTS
3	Lecturers	Felix Freiling	

4	Module coordinator	Felix Freiling
5	Contents	• introduction to cryptography and cryptocurrencies • distributed systems, system and failure models, distributed algorithms • reliable broadcast • logical time and causal broadcast • consensus and total order broadcast • Byzantine agreement • Bitcoin protocols • Nakamoto consensus • Bitcoin mining • Ripple and Payment networks • Redactable blockchain
6	Learning objectives and skills	The students will learn to • understand current protocols behind cryptocurrencies like Bitcoin • analyse their properties and assess their weaknesses • assess the properties of new cryptocurrencies from the literature
7	Recommended prerequisites	Interest in cryptography
5	Integration in curriculum	Second semester
6	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Digital Business (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective)
10	Method of examination	Oral examination, 30 minutes (mündliche Prüfung, 30 Minuten)
11	Grading procedure	Oral examination, 100% (mündliche Prüfung, 100%)
12	Module frequency	Each summer term
13	Workload	Contact hours: 60 h Independent study: 90 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	All relevant material will be provided during the lecture.

Forensische Informatik (ForensInf)

1	Modulbezeichnung 792501	Forensische Informatik	5 ECTS
2	Lehrveranstaltungen	V/UE: Forensische Informatik (4 SWS)	5 ECTS
3	Lehrende	Prof. Freiling	

4	Modulverantwortliche/r	Prof. Freiling
5	Inhalt	Forensische Informatik befasst sich mit der Sammlung, Aufbereitung und Analyse digitaler Beweismittel zur Verwendung vor Gericht. Ausgangspunkt ist jeweils der Verdacht auf einen Computereinbruch oder eine Straftat, die mit Hilfe von digitalen Geräten vorgenommen worden ist. Diese Vorlesung gibt einen Überblick über die Methoden der forensischen Informatik aus einer wissenschaftlichen Perspektive. Der Schwerpunkt liegt auf der Analyse von Dateisystemen. Ziel der Vorlesung ist nicht die Ausbildung von Forensik-Praktikern, sondern die Vermittlung von Kenntnissen, die es einem erlauben, Forschung im Bereich Computereforensik zu betreiben. Voraussichtliche Themen: • Definition forensische Informatik • Der forensische Prozess und seine wissenschaftliche Fundierung • Rechtliche Rahmenbedingungen • Sichern von Festplatten • Analyse verschiedener Dateisysteme (FAT32, NTFS, Ext2/Ext3) • Tools
6	Lernziele und Kompetenzen	Die Studierenden können Termini und Methoden der digitalen Forensik in die Entwicklung der forensischen Wissenschaften einordnen. Die Studierenden können die wesentlichen Datenstrukturen verschiedener Dateisysteme erklären. Sie können die für forensische Zwecke wesentlichen Datenstrukturen lokalisieren und geeignete Werkzeuge zu ihrer Analyse auswählen und anwenden. Die Studierenden können digitale Spuren konkreter Fallkonstellationen durch Anwendung von Werkzeugen rekonstruieren, analysieren, interpretieren und dokumentieren. Sie lernen ihre Untersuchungsergebnisse zu präsentieren und gegenüber kritischen Nachfragen zu verteidigen.
7	Empfohlene Voraussetzungen für die Teilnahme	Keine
7	Einpassung in Musterstudienplan	2. oder 4. Semester
8	Verwendbarkeit des Moduls	Master International Information Systems (from 2018/19): Module in the section Informatics – Digital Business (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics Extension Courses (Elective)
10	Studien- und Prüfungsleistungen	Mündliche Prüfung (30 Minuten)
11	Berechnung Modulnote	Mündliche Prüfung (100%)
12	Turnus des Angebots	Jährlich im Sommersemester
13	Arbeitsaufwand	Präsenzzeit: 60 h Eigenstudium: 90 h
14	Dauer des Moduls	1 Semester
15	Unterrichts- und Prüfungssprache	Deutsch
16	(Vorbereitende) Literatur	Keine

Constructive phases of software engineering (SWE-GL-Konstr +Ü)

1	Module name MSC 71302	Constructive phases of software engineering	5 ECTS
2	Courses/lectures	Foundations of software engineering (lectures + courses, 4 SWS, first 2 months of the semester)	5 ECTS
3	Lecturers	Prof. Saglietti	

4	Module coordinator	Prof. Saglietti
5	Contents	This module addresses a broad spectrum of scientific engineering principles and alternative approaches during the conception and the development of large-scale, complex software systems. They provide a comprehensive overview on constructive techniques in modern software engineering.
6	Learning objectives and skills	Students familiarize with several alternative development approaches and tools differing in their degree of rigor and cost and thus suitable to different types of software projects, depending a. o. on the project size, the company structure or the reliability requirements.
7	Recommended prerequisites	None
8	Integration in curriculum	Second semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Core Course or Elective) Master International Information Systems (from 2016/17): Module in the section Informatics – Software Engineering I or II (Core Course or Elective)
10	Method of examination	90-minute written examination (schriftl. Prüfung (90 min))
11	Grading procedure	Exam: 100% of module score (Prüfung: 100% der Modulnote)
12	Module frequency	Each SS
13	Workload	Contact hours: 60 h Independent study: 90 h
14	Module duration	1 semester
15	Teaching and examination language	German or English
16	(Recommended) reading	None

Process-oriented information systems (POIS)

1	Module name 675090	Process-oriented information systems	5 ECTS
2	Courses/lectures	Lect: Process-oriented information systems (2 SWS) Ex: Process-oriented information systems (2 SWS)	2,5 ECTS 2,5 ECTS
3	Lecturers	Dr. Stiehl (SAP, Lehrbeauftragter)	

4	Module coordinator	Prof. Lenz
5	Contents	In a globalized world enterprises are facing tough challenges as changes are permanently accompanying them. As a consequence companies have to adapt their differentiating business processes in even shorter timeframes. If they do not follow these changes, they are threatening their existence. Ideally the company's IT department can help in overcoming those challenges by taking their part in implementing the company's strategy as fast as possible. Unfortunately the key question remains unanswered: How can an IT department ensure the fast implementation of new strategic processes so that they become a key pillar for a company? This course will address the question from different angles and will come up with solutions which primarily rely on the following three pillars: • a business-process-driven methodology for deriving the essential parts/artifacts of the resulting business application; • a sustainable and flexible architecture for process-driven applications separating the problem space in several layers; • the general use of BPMN (Business Process Model and Notation) for modeling as well as implementing all processes (business processes as well as technical integration processes) of a process-driven application. As the topic is closely related to service-oriented architecture (SOA), the course will also briefly touch the basic technologies and concepts in the SOA domain (e.g. XML, Web Services, SOAP, UDDI registries, repositories, WSDL).
6	Learning objectives and skills	Goals of the course: Identify the use case for process-oriented information systems. Understand the complexity and challenges of process-oriented information systems. Understand the need for a sustainable methodology and architecture to address the challenges. Learn how to separate functionalities in different layers and how to implement each of those layers to keep the flexibility companies require. Use the BPMN (Business Process Model and Notation) standard for modeling and implementing all kinds of processes within a process-oriented application. Embrace the heterogeneous IT landscape in companies which has grown over several years. Learn how the flexibility of applications can be increased by using business rules management systems (BRMS) and analytical applications.
7	Recommended prerequisites	Lecture eBusiness Technologies (EBT).
8	Integration in curriculum	Second semester
9	Module compatibility	Master Computer Science: 5-ECTS-module in major field of study „Database Systems“ Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Core Course or Elective)

		Master in International Information Systems (from 2016/17): Module in the section Informatics – Data Management I or II (Core Course or Elective)
10	Method of examination	60-minute written examination
11	Grading procedure	Exam: 100% (100% der Klausurnote)
12	Module frequency	Each SS
13	Workload	Contact hours: 60 h Independent study: 90 h
14	Module duration	1 Semester
15	Teaching and examination language	English
16	(Recommended) reading	Freund, Jakob; Rücker, Bernd (German version): Praxishandbuch BPMN 2.0. 4., aktualisierte Auflage. München: Hanser, 2012. Freund, Jakob; Rücker, Bernd (English Version): Real-Life BPMN: Using BPMN 2.0 to Analyze, Improve, and Automate Processes in Your Company. 2nd Edition. CreateSpace Independent Publishing Platform, 2014 Göpfert, Jochen; Lindenbach, Heidi: Geschäftsprozessmodellierung mit BPMN 2.0: Business Process Model and Notation. Oldenbourg Verlag, 2013. Josuttis, Nicolai: SOA in Practice: The Art of Distributed System Design. O'Reilly, 2007. Hohpe, Gregor; Woolf, Bobby: Enterprise Integration Patterns: Designing, Building, and Deploying Messaging Solutions. Addison-Wesley, 2010. Silver, Bruce: BPMN Method and Style: A structured approach for business process modeling and implementation using BPMN 2.0. 2nd Edition. Cody-Cassidy Press, 2011 Stiehl, Volker (German version): Prozessgesteuerte Anwendungen entwickeln und ausführen mit BPMN: Wie flexible Anwendungsarchitekturen wirklich erreicht werden können. Heidelberg: dpunkt.verlag, 2013. Stiehl, Volker (English version): Process-Driven Applications with BPMN. Springer, 2014

Fehlertolerierende Softwarearchitekturen (SWE-FT)

1	Module name 869140	Fehlertolerierende Softwarearchitekturen	5 ECTS
2	Courses/lectures	Fehlertolerierende Softwarearchitekturen (lectures + courses, 4 SWS)	5 ECTS
3	Lecturers	Prof. Saglietti	

4	Module coordinator	Prof. Saglietti
5	Contents	This module addresses redundant approaches supporting the tolerance of sporadic software failures during operation.
6	Learning objectives and skills	The students will acquire knowledge - on constructive approaches to software fault tolerance, particularly concerning the optimization of the architectural aspects involved (form and degree of redundancy, properties of adjudication mechanisms) - on qualitative and quantitative analysis techniques for the assessment of redundant computer systems, including in particular diverse software systems.
7	Recommended prerequisites	None
8	Integration in curriculum	Third semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics – Software Engineering II (Elective)
10	Method of examination	30-minute oral examination (mündl. Prüfung (30 min))
11	Grading procedure	Exam: 100% of module score (Prüfung: 100% der Modulnote)
12	Module frequency	Each WS
13	Workload	Contact hours: 60 h Independent study: 90 h
14	Module duration	1 semester
15	Teaching and examination language	German or English
16	(Recommended) reading	None

Applied Software Engineering Master-Projekt (OSS-PROJ)

1	Module name 93141	Applied Software Engineering Master-Projekt	10 ECTS
2	Courses/lectures	Applied Software Engineering Master-Projekt	10 ECTS
3	Lecturers	Prof. Dirk Riehle	

4	Module coordinator	Prof. Dirk Riehle
5	Contents	This module lets students fulfill their degree program's project obligation by performing a project in software engineering and/or open source. We prefer that you use one of our existing courses for your project obligation, but are willing to have you for a one-off topic if none of our courses fit. Project topics should be in the domain of (applied) software engineering and may or may not include open source software as a topic. The work result is most likely a new software component, but this depends on the specific topic we agreed upon.
6	Learning objectives and skills	- Students learn to program a software component as part of one of our projects - Students learn to work with a lead programmer in a continuous delivery process
7	Recommended prerequisites	None
8	Integration in curriculum	Second/third semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Elective)
10	Method of examination	Project work: 100% of the final grade
11	Grading procedure	Project work: 100% of the final grade
12	Module frequency	SS+WS
13	Workload	Contact hours: 0 h Independent study: 300 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	None

eBusiness technologies und Evolutionäre Informationssysteme (EBTEIS)

1.	Modulbezeichnung 710850	eBusiness technologies und evolutionäre Informationssysteme (E-business technologies and Evolutionary information systems)	5 ECTS
2.	Lehrveranstaltungen	V: eBusiness technologies (2 SWS) V: Evolutionäre Informationssysteme (2 SWS)	2,5 ECTS 2,5 ECTS
3.	Lehrende	Dr. Irmert, Dr. Neumann (Lehrbeauftragte), Prof. Lenz	

4.	Modulverantwortliche/r	Prof. Dr. Richard Lenz
5.	Inhalt	EBT: • Überblick und Einblick in die wichtigsten Themen des Bereichs e-Business: Von den Anwendungen bis zu den Implementierungen • Vorgehen: Klassifikation, Ordnung von Techniken und Methoden; Bewertung • Einführung: eBusiness als Anwendung, Definition der Integration, B2B Integration, Realisierung von eBusiness-Anwendungen (WAA, WPA) • Architektur: Grundlagen des Webs, HTTP-/Web-/Application Server • Implementierung: Markup Languages (HTML, XML), Enterprise Java Beans, J2EE, DB-Zugriffstechniken, Web Services EIS: • Grundlagen rechnergestützter Informationssysteme und Organisatorisches Lernen • Erfolgsfaktoren für IT-Projekte • Software-Wartung vs. Software-Evolution • Architekturmodelle • Grundprinzipien evolutionärer Systeme • Anwendungsintegration • Datenqualität in Informationssystemen
6.	Lernziele und Kompetenzen	EBT: Die Studierenden - identifizieren die wichtigsten Themen des Bereichs eBusiness, von den Anwendungen bis zu den Implementierungen - verstehen Zusammenhänge der B2B Integration und der Realisierung von eBusiness-Anwendungen - wiederholen Grundlagen des Webs - vergleichen technische Eigenschaften von HTTP-, Web- und Application Servern - vergleichen Markup Languages (HTML, XML) - unterscheiden Ansätze zur Schema-Modellierung wie DTD und XML Schema und erkennen die unterschiedliche Leistungsfähigkeit - verstehen Methoden zur evolutionsfähigen Gestaltung von Datenstrukturen in XML - unterscheiden Vorgehen bei der Datenhaltung und verschiedene Ansätze für den Datenbankzugriff - verstehen Objekt-relationale Mapping Frameworks am Beispiel von Hibernate und JPA - verstehen Komponentenmodelle wie Enterprise JavaBeans (EJB) aus dem JEE Framework - unterscheiden das EJB Komponentenmodell von den OSGi Bundles und den Spring Beans - verstehen und unterscheiden grundlegende Web Service Techniken wie SOAP und WSDL - unterscheiden Herangehensweisen zur dynamischen Generierung von Webseiten - verstehen grundlegende Eigenschaften eines Java-basierten Front-End-Frameworks am Beispiel von JSF

		- verstehen grundlegende Eigenschaften von Service-orientierten Architekturen (SOA) - verstehen agile Vorgehensmodelle zur Software-Entwicklung am Beispiel von Scrum - unterscheiden agile Verfahren wie Scrum von iterativ-inkrementellen Verfahren wie RUP - verstehen die Wichtigkeit von Code-Beispielen um die praktische Anwendbarkeit des theoretischen Wissens zu veranschaulichen. - können die Code-Beispiele eigenständig zur Ausführung bringen und die praktischen Erfahrungen interpretieren und bewerten - gestalten eigene Lernprozesse selbständig. - schätzen ihre eigenen Stärken und Schwächen im Hinblick auf die unterschiedlichen Architektur-Schichten ein (Benutzerinteraktion, Applikationslogik, Schnittstellenintegration, Datenbanksysteme) - identifizieren eine eigene Vorstellung als zukünftige Software-Architekten und können die eigene Entwicklung planen - reflektieren durch regelmäßige fachbezogene Fragen des Dozenten Ihre eigene Lösungskompetenz. EIS: Die Studierenden: - definieren die Begriffe "Informationssysteme", "evolutionäre Informationssysteme" und "organisatorisches Lernen" - grenzen die Begriffe "Wissen" und "Information" gegeneinander ab - charakterisieren die in der Vorlesung erläuterten Formen der organisatorischen Veränderung - erklären das SEKI Modell nach Nonaka und Takeuchi - nennen Beispiele für die in der Vorlesung behandelten Formen der Wissensrepräsentation in IT-Systemen - nennen typische Erfolgs- und Risikofaktoren für große IT-Projekte - erklären die Kraftfeldtheorie nach Kurt Lewin - unterscheiden Typen von Software gemäß der Klassifikation nach Lehman und Belady - unterscheiden die in der Vorlesung vorgestellten Arten der Software Wartung - benennen die Gesetzmäßigkeiten der Software-Evolution nach Lehman und Belady - bewerten die in der Vorlesung vorgestellten Vorgehensmodelle zur Softwareerstellung im Kontext der E-Typ-Software - nennen die in der Vorlesung vorgestellten Aspekte der Evolutionsfähigkeit von Software - erklären, wie die in der Vorlesung vorgestellten Methoden zur Trennung von Belangen beitragen - erklären das Konzept des "Verzögerten Entwurfs" - erklären die Vor- und Nachteile generischer Datenbankschemata am Beispiel von EAV und EAV/CR - charakterisieren die in der Vorlesung vorgestellten Architekturkonzepte - grenzen die in der Vorlesung vorgestellten Integrationsanforderungen gegeneinander ab - erklären wie Standards zur Systemintegration beitragen und wo die Grenzen der Standardisierung liegen - erklären das Prinzip eines Kommunikationsservers und der nachrichtenbasierten Integration - erklären den Begriff "Prozessintegration" - definieren den Begriff "Enterprise Application Integration" (EAI) - unterscheiden die in der Vorlesung vorgestellten Integrationsansätze - erklären die in der Vorlesung vorgestellten Dimensionen der Datenqualität - unterscheiden die grundlegenden Messmethoden für Datenqualität
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		- erklären das Maßnahmenportfolio zur Verbesserung der Datenqualität nach Redman - benennen die in der Vorlesung vorgestellten Methoden zur Verbesserung der Datenqualität
7.	Empfohlene Voraussetzungen für die Teilnahme	Module "Algorithmen und Datenstrukturen" (wg. Objektorientierung), "Konzeptionelle Modellierung" (wg. Datenmodellierung und UML), "Softwareentwicklung in Großprojekten" (wg. Entwurfsmustern und IT-Vorgehensmodellen), "Systemprogrammierung" (wg. Betriebssystem-Architektur), "Berechenbarkeit und formale Sprachen" (als Grundlage für XML) und "Rechnerkommunikation" (wg. Transferprotokollen), "Datenbanksysteme" – ggf. parallel (wg. Schichtenarchitektur und Transaktionen). Die relevanten Inhalte können ggf. auch in anderen Modulen erworben worden sein.
8.	Einpassung in Musterstudienplan	drittes Semester
9.	Verwendbarkeit des Moduls	Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Elective) Master in International Information Systems (from 2016/17): Modul im Bereich Informatics – Data Management I oder II (Core Course oder Elective).
10.	Studien- und Prüfungsleistungen	mündliche Prüfung (30 Minuten)
11.	Berechnung Modulnote	Ergebnis der mündlichen Prüfung
12.	Turnus des Angebots	jährlich, im Wintersemester
13.	Arbeitsaufwand	Präsenzzeit: 60h (4h x 15) Eigenstudium: 90h (2h x 15 + 60h) ca. 2h pro Woche Nachbereitung im laufenden Semester und ca. 60h Prüfungsvorbereitung in der vorlesungsfreien Zeit; erfolgt keine begleitende Nachbereitung, sind ca. 90h für die Prüfungsvorbereitung einzukalkulieren.
14.	Dauer des Moduls	1 Semester
15.	Unterrichts- und Prüfungssprache	Deutsch
16.	(Vorbereitende) Literatur	EBT: Michael Merz: E-Commerce und E-Business. 2. Aufl. dpunkt Verlag, 2002 Craig Larman: Applying UML and Patterns. 3rd ed. Prentice Hall, 2004 Dan Pilone, Russ Miles: Head First Software Development. 1. Aufl. O'Reilly Media, 2007 Rod Johnson: Expert One-on-one J2EE Design and Development. Wiley & Sons, 2003 Bernd Müller: JBoss Seam. 1. Aufl. Hanser Fachbuch, 2007 Craig Walls, Ryan Breidenbach: Spring in Action. 2. Aufl. Manning Publications, 2007 EIS: Nandish Patel: Adaptive Evolutionary Information Systems. Idea Group Publishing, 2003.

Software-Projektmanagement (PSWT-SPM)

1	Module name 312443	Software-Projektmanagement (PSWT-SPM)	5 ECTS
2	Courses/lectures	Lect: Software project management (4 SWS) (PSWT-SPM)	5 ECTS
3	Lecturers	Prof. Hindel	

4	Module coordinator	Prof. Hindel
5	Contents	Zahlreiche Statistiken zeigen: Nur wenige Software-Projekte werden erfolgreich (hinsichtlich Zeit-, Budget- und Funktionsvorgaben) abgeschlossen. Sehr viele Projekte werden nur mit erheblichen Defiziten zu Ende gebracht, noch viel zu viele scheitern gänzlich. Oft liegen die Gründe im ungenügenden Projektmanagement. Die Vorlesung gibt einen Überblick zu grundlegenden Disziplinen des Projektmanagements und zeigt deren Wirkungsweisen an Hand von Praxisbeispielen. Gliederung: 1. Einführung Grundbegriffe des Projektmanagements, unterschiedliche Projektgrößen, unterschiedliche Projektarten, Erfolg und Misserfolg in Projekten 2. Projektstart und Planung, Kickoff-Meeting, Anforderungssammlung, Projektstrukturplan, Aufwandsschätzung, Aktivitäten-, Ressourcen- und Kostenplan 3. Projektkontrolle und Steuerung, Fortschrittsüberwachung, Besprechungen, Berichte, Änderungsmanagement 4. Personalmanagement, Der Faktor Mensch, Teamwork, Führungsgrundsätze, Gesprächsstrategien, Konflikte lösen 5. Änderungsmanagement Konfigurationen, Änderungswünsche, Change Control Board, Built- und Release-Mechanismen 6. Qualitäts- und Risikomanagement Qualitätsplan, Audits und Reviews, Risikoermittlung, Risikobewertung und Verfolgung, Gegenmaßnahmen 7. Reifegrad Modelle und Standards CMMI, SPiCE, ISO9001, ISO/IEC12207
6	Learning objectives and skills	Die Studierenden • kennen die Grundbegriffe des Projektmanagements • unterscheiden unterschiedliche Projektgrößen, unterschiedliche Projektarten • verstehen die Ursachen für Erfolg und Misserfolg in Projekten • planen selbständig Projekte und organisieren das Kickoff-Meeting • erstellen Anforderungen, Projektstrukturplan, Aufwandsschätzung, Aktivitäten-, Ressourcen- und Kostenplan • verstehen Projektkontrolle und Steuerung, Fortschrittsüberwachung, Besprechungen, Berichte, Änderungsmanagement • kennen die Grundzüge des Personalmanagements (Der Faktor Mensch, Teamwork, Führungsgrundsätze, Gesprächsstrategien, Konflikte lösen) • planen und steuern Änderungsmanagement (Konfigurationen, Änderungswünsche, Change Control Board, Built- und Release-Mechanismen) • setzen Qualitäts- und Risikomanagement ein (Qualitätsplan, Audits und Reviews, Risikoermittlung, Risikobewertung und Verfolgung, Gegenmaßnahmen) • kennen die wichtigsten Reifegrad Modelle und Standards (CMMI, SPiCE, ISO9001, ISO/IEC12207)

7	Recommended prerequisites	Praktische Softwaretechnik
8	Integration in curriculum	Drittes Semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Core Course or Elective) Master International Information Systems (from 2016/17): Module in the section Informatics – Applied Software Engineering I or II (Core Course or Elective)
10	Method of examination	Aktive Mitarbeit in der Übung über Hausaufgaben und Kolloquium.
11	Grading procedure	100% der Modulnote
12	Module frequency	Jedes Wintersemester
13	Workload	Präsenzzeit: 60 h Eigenstudium: 90 h
14	Module duration	1 Semester
15	Teaching and examination language	Deutsch
16	(Recommended) reading	Hindel et al.: „Basiswissen Software-Projektmanagement“, 3.Auflage, dpunkt.verlag 2009, ISBN 978-3-89864-561-4

Testing of software systems (TSWS)

1	Modulbezeichnung 189989	Testing of software systems	5 ECTS
2	Lehrveranstaltungen	Testing of software systems (4 SWS)	5 ECTS
3	Lehrende	Dr.-Ing. Dussa-Zieger Dr.-Ing. Oster	

4	Modulverantwortliche/r	Prof. Riehle
5	Inhalt	- Grundlagen (Motivation, Testprozess, Psychologie) - Testen im Softwarelebenszyklus (Teststufen) - Integrationstest (big-bang, bottom-up, top-down, u.a.) - Testarten (functional=black, strukturell=white, modellbasiert) - Statische Analysen, Reviews u.a. - Testmanagement (TM/MTI/TPI, Team/Personal-Aspekte) - Werkzeuge - Risikomanagement - Testbewertung (Mutationsanalyse) - Statistisches Testen (Zuverlässigkeitswachstum, Probabilistischer Test) - Formale Methoden (Model Checking, Theorem Proving)
6	Lernziele und Kompetenzen	Beherrschen der grundlegenden Terminologie. Fähigkeit, eigenständig Testprozesse zu definieren und aufzusetzen. Verständnis der Vor- und Nachteile unterschiedlicher Test- und Analysestrategien. Über die Grundlagen der Software-Qualitätssicherung hinausgehende Methoden und Werkzeuge kennenlernen, die insbesondere auch für sicherheitskritische Softwaresysteme von Bedeutung sind.
7	Empfohlene Voraussetzungen für die Teilnahme	Es wird empfohlen, das Modul „Praktische Softwaretechnik“ vorher zu belegen. Die relevanten Inhalte können ggf. auch in anderen Modulen erworben worden sein.
8	Einpassung in Musterstudienplan	Zweites Semester
9	Verwendbarkeit des Moduls	BA CE: Technisches Wahlfach Informatik MA CE: Wahlpflichtfach Informatik BA Informatik: Wahlpflichtmodul der Vertiefungsrichtung Software Engineering, im 5. oder 6. Semester MA Informatik: Wahlpflichtmodul der Vertiefungsrichtung Software Engineering Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Elective) Master International Information Systems (from 2016/17): Modul im Bereich Informatics – Applied Software Engineering II (Elective) BA IuK: Wahlfach 5. oder 6. Semester Zukünftig auch MA IuK
10	Studien- und Prüfungsleistungen	30 Min. mündliche Prüfung
11	Berechnung Modulnote	100 % der Modulnote

12	Turnus des Angebots	jedes SS
13	Arbeitsaufwand	Präsenzzeit: 60 h Eigenstudium: 90 h
14	Dauer des Moduls	1 Semester
15	Unterrichts- und Prüfungssprache	Deutsch (bei Bedarf auch Englisch)
16	(Vorbereitende) Literatur	Keine

Analysis and design with UML (PSWT-OOAD)

1	Module name 510375	Analysis and design with UML (PSWT-OOAD)	5 ECTS
2	Courses/lectures	Analysis and design with UML (Lecture with exercises, 4 SWS) (PSWT-OOAD)	5 ECTS
3	Lecturers	Prof. Kips, Martin Jung	

4	Module coordinator	Prof. Kips
5	Contents	In recent years OMG („Object Management Group“) has established UML („Unified Modeling Language“) as the world wide accepted standard for analysis and design of object oriented software. A broad repertoire of graphical and textual methods enables the user to express the requirements for the system to be developed and to define the static and dynamic properties in a semi-formal way. The lecture will introduce syntax and semantics of the UML in detail. Furthermore, students will learn how UML can be used during all phases of a "typical" software development process. For this purpose, the different diagram types and notation elements of UML are introduced step by step and used in a continuous application example.
6	Learning objectives and skills	• overview of all relevant UML notation elements accompanied with an informal introduction to their semantics • establishing a basic understanding of the UML metamodel approach • introduction of a typical methodology for developing an object oriented analysis and design model based on UML notation using a non-trivial real world problem example • establishing a well founded understanding of relations between the various levels of an UML based system model
7	Recommended prerequisites	Successful completion of the module „Praktische Softwaretechnik“. The prerequisites for taking this module may also have been acquired in other modules.
8	Integration in curriculum	Second semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics – Applied Software Engineering I or II (Core Course or Elective)
10	Method of examination	30min. oral examination (30 minütige mündliche Prüfung)
11	Grading procedure	100 % of module score (100% der Modulnote)
12	Module frequency	each SS
13	Workload	Contact hours time: 60 h Self study: 90 h
14	Module duration	1 semester
15	Teaching and examination language	German
16	(Recommended) reading	Rumbaugh, J.; Booch, G.; Jacobson, I.: The Unified Modeling Language Reference Manual, AddisonWesley, 2004 Hitz, M.; Kappel, G.; Kapsammer, E.; Retschitzegger, W.: UML @ work , 3., aktualisierte und überarbeitete Auflage, dpunkt-Verlag, 2005

		Winter, M.: Methodische objektorientierte Softwareentwicklung, dpunkt-Verlag, 2005 Störrle, H.: UML 2 erfolgreich einsetzen, Addison-Wesley, 2007 • Rumpe, B.: Modellierung mit UML: Sprache, Konzepte und Methodik, Springer-Verlag, 2. Auflage, 2011 Seidl, M., Brandsteidl, M., Huemer, C., Kappek, G.: UML@classroom - Eine Einführung in die objektorientierte Modellierung, dpunkt-Verlag, 2012 Rupp, C.; Queins, S., et al. UML 2 glasklar: Praxiswissen für die UML-Modellierung, Carl Hanser Verlag, 2012
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Advanced design and programming (OSS-ADAP)

1	Module name 280491	Advanced design and programming (OSS-ADAP)	5 ECTS
2	Courses/lectures	Lecture and exercise: Advanced design and programming (OSS-ADAP) (4 SWS)	5 ECTS
3	Lecturers	Prof. Riehle	

4	Module coordinator	Prof. Riehle
5	Contents	Dieser Kurs wird auf Deutsch gehalten. This course teaches principles and practices of advanced object-oriented design and programming. It is a 4 SWS class with additional homework and self-study, totaling 5 ECTS. This is a hands-on course and students should be familiar with their Java IDE. Students learn the following concepts: • Class-Level ○ Method design ○ Class design ○ Classes and interfaces ○ Subtyping and inheritance ○ Implementing inheritance ○ Design by contract • Collaboration-Level ○ Values vs. objects ○ Role objects ○ Type objects ○ Object creation ○ Collaboration-based design ○ Design patterns • Component-Level ○ Error handling ○ Meta-object protocols ○ Frameworks ○ Components ○ Domain-driven design ○ API evolution The running example is the photo sharing and rating software Wahlzeit, see https://github.com/dirkriehle/wahlzeit. Class is held as a three hour session with a short break in between. The class iterates over short lectures, discussion, and exercise chunks of 10-30min each. Students should bring a laptop with a working Java programming setup. The overall schedule can be found at http://goo.gl/bePPn. Please sign up for the course on StudOn (link accessible through schedule spreadsheet) as soon as possible.
6	Learning objectives and skills	Students will learn to - recognize, analyse, and apply advanced concepts of object-oriented design and programming - work effectively with a realistic tool set-up, involving an IDE, config-mgmt, and a service hoster

7	Recommended prerequisites	INF-AuD
8	Integration in curriculum	During or after first semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Elective) Master International Information Systems (2016/17): Module in the section Informatics – Applied Software Engineering II (Elective)
10	Method of examination	- class participation (Teilnahme am Unterricht) - homework provision (Hausarbeit)
11	Grading procedure	Classwork (40%) + homework (60%)
12	Module frequency	Each WS
13	Workload	60h in class, 90h pre- and post-work
14	Module duration	1 semester
15	Teaching and examination language	German
16	(Recommended) reading	See http://goo.gl/BZpU8

Software architecture (PSWT-ARCH)

1	Module name 600674	Software architecture (PSWT-ARCH)	5 ECTS
2	Courses/lectures	Software architecture (Lecture with exercises, 4SWS) (PSWT-ARCH)	5 ECTS
3	Lecturers	Dr. Jung Prof. Riehle, M.B.A	

4	Module coordinator	Prof. Riehle, M.B.A	
5	Contents	Die Architektur eines Softwaresystems beschreibt die wesentlichen Komponenten des Systems, ihre Beziehungen und Struktur, sowie das Verhalten und die Dynamik der Beziehungen und Struktur dieser Komponenten. Dieser Kurs vermittelt in einer Vorlesung zunächst die folgenden Aspekte von Softwarearchitektur: • Grundlegende Bausteine und ihre Beziehungen • Softwarearchitekturbeschreibungssprachen • Softwarearchitekturstile und -muster • Bibliotheken, Rahmenwerke und Plattformen • Formale sowie de-facto Industriestandards • Die Softwarearchitekturen von Beispielsystemen • Nicht technische Kriterien in der Architektur • Werkzeuge für Softwarearchitekten • Vorgehensmodelle der Softwarearchitektur • Architekturgetriebene Entwicklung • Die Rolle und Funktion der Softwarearchitektin Am Kurs kann in einer von zwei Varianten teilgenommen werden. In der 5-ECTS-Variante nehmen Studierende an der Vorlesung teil und reichen Hausaufgaben ein. Die 10-ECTSVariante erweitert die 5-ECTS-Variante um ein Projekt. Die Projekte werden von unseren Industriepartnern bereitgestellt. Hier dokumentieren, analysieren und bewerten Studierende die Softwarearchitektur eines realen Softwaresystems. Diese verschiedenen Aspekte werden im Laufe des Semesters inkrementell abgearbeitet und am Ende dem Industriepartner in einer Präsentation vorgestellt. ARCH projects are run as shared projects, in which all participants contribute and get to participate in the project results. Read more at https://wp.me/pDU66-2p4. Der Unterricht findet als 3h-Block während der Vorlesungszeit statt. Der Zeitplan befindet sich hier: http://goo.gl/ZXJjg. Der Zeitplan enthält auch einen Link auf den zur Veranstaltung gehörigen StudOn Kurs. Bitte registrieren Sie sich auf StudOn sobald wie möglich, um sicherzustellen, dass Sie einen Platz im Kurs erhalten werden.	
6	Learning objectives and skills	- Ganzheitliches Verständnis des Konzepts „Softwarearchitektur“ - Befähigung zur Bewertung, Auswahl und Konstruktion problemangemessener Architekturen - Kenntnis architekturgetriebener Entwicklungsmethodik und entsprechender Werkzeuge - Kenntnis der typischen Verantwortlichkeiten und der Methodik eines Softwarearchitekten	
7	Recommended prerequisites	General: PSWT-PSWT	

8	Integration in curriculum	Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics – Applied Software Engineering II (Elective)
9	Module compatibility	• 5 ECTS: Vorlesung + Übungen • 10 ECTS: Projekt • 10 ECTS: Vorlesung + Übungen
10	Method of examination	- Unterricht - Hausaufgaben - Mündliche Prüfung - Projektarbeit
11	Grading procedure	- 5 ECTS: Unterricht (10%) + Hausaufgaben (40%) + mündliche Prüfung (50%) - 10 ECTS: 5 ECTS (50%) + Projektarbeit (50%)
12	Module frequency	Alle zwei Semester (SS). Kurs wird im SS2021 nicht angeboten.
13	Workload	• 5 ECTS Version: 60h Unterricht + 90h Eigenarbeit • 10 ECTS Version: 5 ECTS Version + 150h Projektarbeit
14	Module duration	1 Semester
15	Teaching and examination language	Deutsch
16	(Recommended) reading	http://goo.gl/ou7mja

Software development in large projects (SoSy3 + Ü)

 The module can be chosen as an elective only, if it has not yet been selected as a core module or as a customized introduction.

 Das Modul kann nur dann im Wahlbereich verwendet werden, wenn es nicht bereits im Kernbereich oder in der Customized Introduction gewählt wurde.

1	Module name TEC 31601	Software development in large projects	5 ECTS
2	Courses/lectures	Software development in large projects (lectures + exercises, 4 SWS)	5 ECTS
3	Lecturers	Prof. Saglietti	

4	Module coordinator	Prof. Saglietti	
5	Contents	• Introduction to the single phases of software development: requirements analysis, specification, design, implementation, test, maintenance • Exemplifying application of selected, representative techniques supporting the developments phases mentioned above • Ergonomic principles for usage interfaces • Object-oriented analysis and design with UML • Design patterns as constructive, re-usable solutions to whole classes of problems • Automatic support for code implementation from UML diagrams • Testing strategies • Re-factoring techniques supporting the maintenance phase	
6	Learning objectives and skills	On the basis of programming skills already acquired the students will • learn systematic and structured approaches to deal with the complexity of "developing in the large", • gain the capability of expressing complex problems in a well-defined way by means of appropriate specification languages, of analyzing such problems, as well as of deriving appropriate designs for their solution, • get experience in the application of UML diagrams for the purpose of object-oriented analysis and design activities, • get proficiency in re-using general design solutions by specialization of established design patterns, • get acquainted with principles of the testing process, • get familiar with re-factoring strategies aimed at increasing systematically software modifiability.	
7	Recommended prerequisites	None	
8	Integration in curriculum	Third semester	
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics – Software Engineering I or II (Core Course or Elective) or	

		Master in International Information Systems (2018/19 + 2016/17): Module in the section Customized Introduction to IIS (Informatics)
10	Method of examination	90-minute written examination (schriftl. Prüfung (90 min)
11	Grading procedure	Exam: 100% (Klausurnote: 100%)
12	Module frequency	Each WS
13	Workload	Contact hours: 60h Independent study: 90h
14	Module duration	1 semester
15	Teaching and examination language	German or English
16	(Recommended) reading	None

Software reliability (SWE-ZUV)

1	Module name 357823	Software reliability	5 ECTS
2	Courses/lectures	Software reliability (lectures + courses, 4 SWS)	5 ECTS
3	Lecturers	Prof. Saglietti	

4	Module coordinator	Prof. Saglietti
5	Contents	This module addresses quantitative approaches for the determination of the reliability degree achieved by a software system during and after testing.
6	Learning objectives and skills	- Students learn systematic procedures allowing to estimate software reliability of conventional products during testing; such estimates offer support to the project manager for the purpose of determining the optimal time for product release. - Students learn systematic procedures allowing to demonstrate the achievement of reliability and availability targets by well-founded statistical approaches as required by licensors of mission-critical software systems.
7	Recommended prerequisites	None
8	Integration in curriculum	Second semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics – Software Engineering II (Elective)
10	Method of examination	30-minute oral examination (mündl. Prüfung (30 min))
11	Grading procedure	Exam: 100% of module score (Prüfung: 100% der Modulnote)
12	Module frequency	Each SS
13	Workload	Contact hours: 60 h Independent study: 90 h
14	Module duration	1 semester
15	Teaching and examination language	German or English
16	(Recommended) reading	None

Foundations of software engineering and Design patterns and anti-patterns (SWE-GL + Design patterns)

1	Module name 113545	Foundations of software engineering and Design patterns and anti-patterns	10 ECTS
2	Courses/lectures	Course 1: Foundations of software engineering (lectures + courses, 6 SWS) Course 2: Design patterns and anti-patterns (seminar, 2 SWS, compulsory attendance)	7,5 ECTS 2,5 ECTS
3	Lecturers	Prof. Saglietti	

4	Module coordinator	Prof. Saglietti
5	Contents	This module presents an extensive overview on software engineering throughout the complete software life-cycle, including technical (constructive and analytical approaches), as well as organizational measures (project management, software metrics), with particular emphasis on novel design technologies enhancing design re-usability by means of logical patterns. Course 1 addresses a broad spectrum of scientific engineering principles and approaches during the conception, development and analysis of large-scale, complex software systems, including human factors, software metrics for quality assurance and control, cost models and personnel management. Course 2 covers classical design patterns and anti-patterns in software development. Design patterns systematically describe general solutions for recurring software design problems. They also offer a common vocabulary to software engineers, thus substantially facilitating their communication. On the other hand, anti-patterns describe poor, unfortunately typical solutions to software design problems for which preferable alternative solutions are presented.
6	Learning objectives and skills	- Students familiarize with several alternative development, analysis and management approaches differing in their degree of rigor and cost and thus suitable to different types of software projects, depending a. o. on the project size, the company structure or the reliability requirements. - In addition to learning modern software engineering techniques, the students will achieve and intensify their communicational skill in preparing and giving a technical talk as well as in contributing to the discussion with the members of the audience.
7	Recommended prerequisites	None
8	Integration in curriculum	Second semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics – Software Engineering II (Elective)
10	Method of examination	Course 1:

		90-minute written examination (Kurs 1: schriftl. Prüfung (90 min)) Course 2: 60-minute presentation and 15-minute oral examination (Kurs 2: Präsentation (60 min) und abschl. mündl. Prüfung (15 min))
11	Grading procedure	Course 1: 75% Course 2: 13% presentation, 12% oral examination
12	Module frequency	Course 1: Each summer term Course 2: Each summer term (without guarantee)
13	Workload	Contact hours: 120 h Independent study: 180 h
14	Module duration	1 semester
15	Teaching and examination language	German or English
16	(Recommended) reading	none

Foundations of software engineering and Software engineering in practice (SWE-GL + SWE-PR)

1	Module name 234129	Foundations of software engineering and Soft-ware engineering in practice	10 ECTS
2	Courses/lectures	Course 1: Foundations of software engineering (lectures + courses, 6 SWS) Course 2: Software engineering in practice (practical exercises, 3 SWS)	7,5 ECTS 2,5 ECTS
3	Lecturers	Prof. Saglietti	

4	Module coordinator	Prof. Saglietti
5	Contents	This module presents an extensive overview on software engineering throughout the complete software life-cycle, including technical (constructive and analytical approaches), as well as organizational measures (project management, software metrics), with particular emphasis on novel design technologies enhancing design re-usability by means of logical patterns. - Course 1 addresses a broad spectrum of scientific engineering principles and approaches during the conception, development and analysis of large-scale, complex software systems, including human factors, software metrics for quality assurance and control, cost models and personnel management. - During course 2 different CASE (Computer Aided Software Engineering) tools are presented, covering all relevant aspects of analysis and development of complex software. The benefit of applying such tools in industrial-size projects are experienced by the attendees by solving typical problems arising in software projects both on their own and under supervision.
6	Learning objectives and skills	- Students familiarize with several alternative development, analysis and management approaches differing in their degree of rigor and cost and thus suitable to different types of software projects, depending a. o. on the project size, the company structure or the reliability requirements. - Students familiarize with several software engineering tools differing in their degree of rigor and cost and thus suitable to different types of software projects, depending a. o. on the project size, the company structure or the reliability requirements.
7	Recommended prerequisites	None
8	Integration in curriculum	Second semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics – Software Engineering II (Elective)
10	Method of examination	Course 1: 90-minute written examination (Kurs 1: schriftl. Prüfung (90 min)) Course 2: 60-minute examination using PC (Kurs 1: Prüfung (60 min) am Rechner)

11	Grading procedure	Course 1: 75% of module score (Kurs 1: 75% der Modulnote) Course 2: 25% of module score (Kurs 2: 25% der Modulnote)
12	Module frequency	Course 1: Each summer term Course 2: Each semester (without guarantee)
13	Workload	Contact hours: 120 h Independent study: 180 h
14	Module duration	1-2 semester
15	Teaching and examination language	German or English
16	(Recommended) reading	none

Test and Analysis Techniques for Software Verification and Validation (SWE-VV + Ü)

1	Module name MSC 32001	Software test and analysis (Verification and validation)	5 ECTS
2	Courses/lectures	Software test and analysis (Verification and validation) (lectures + exercises, 4 SWS)	5 ECTS
3	Lecturers	Prof. Saglietti	

4	Module coordinator	Prof. Saglietti
5	Contents	The module addresses the topic of analyzing and testing software systems, especially in case of embedded software applied to safety-relevant complex applications. Depending on the degree of reliability required, numerous techniques for testing and analysis at different levels of rigor are presented, addressing both approaches to detect faults during the development process (verification) and approaches to detect faults during the requirements phase (validation), thus covering the whole spectrum of verification and validation (so-called V & V).
6	Learning objectives and skills	The students will acquire knowledge on: • system analysis: failure mode & effect, fault tree analysis • risk analysis & safety classes according to international standards, • testing strategies required for the certification of highly reliable software, in particular structural-based coverage criteria • analysis techniques supporting automatic proofs of correctness or the automatic generation of counter-examples
7	Recommended prerequisites	None
8	Integration in curriculum	Third semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Elective) Master International Information Systems (from 2016/17): Module in the section Informatics – Software Engineering II (Elective)
10	Method of examination	30-minute oral examination (mündl. Prüfung (30 min))
11	Grading procedure	Exam: 100% (100% der Klausurnote)
12	Module frequency	Each WS
13	Workload	Contact hours: 60h Independent study: 90h
14	Module duration	1 semester
15	Teaching and examination language	English (Exercises in German if required)
16	(Recommended) reading	None

Extension courses

Verteilte Systeme

1	Modulbezeichnung 649073	Verteilte Systeme-V+Ü Distributed Systems – L+E	5 ECTS
2	Lehrveranstaltungen	Verteilte Systeme (Vorlesung, 2 SWS, Dozent: Dr.-Ing. Tobias Distler) Übungen zu Verteilte Systeme (Übung, 2 SWS, Dozent: Dr.-Ing. Tobias Distler)	2,5 ECTS 2.5 ECTS
3	Lehrende	Dr.-Ing. Distler, Dr.-Ing. Kleinöder	

4	Modulverantwortliche/r	Dr.-Ing. Distler
5	Inhalt	Bestandsaufnahme, Beispiele Verteilter Systeme, Problembereiche, Client-Server-Systeme - Grundlagen - Fernaufrufe - Effizienz - Fehlertoleranz Replizierte Systeme - Replikationstechniken - Kommunikation innerhalb einer Replikatgruppe - Georeplikation Verteilte Algorithmen - Synchronisation von Uhren - Gegenseitiger Ausschluss - Wahl eines Anführerknotens Inhalt der Übungen: Implementierung eines Java-RMI-ähnlichen Fernaufrufsystems (Dynamische Generierung von Proxies, Rückruf/Callback, RPC-Semantiken) Aktive Replikation von Diensten Lesen und Begutachten von Fachliteratur Verteilte Synchronisation
6	Lernziele und Kompetenzen	Die Studierenden - erwerben fundierte Kenntnisse über Grundlagen von verteilten Systemen - verstehen Zusammenhänge, die die verteilte Ausführung von Programmen in vernetzten Rechensystemen ermöglichen - erlernen die verteilte Programmierung in Java - entwickeln eine Middleware-Plattform zur Ausführung verteilter Programme
7	Empfohlene Voraussetzungen für die Teilnahme	Gute Programmierkenntnisse in Java
8	Einpassung in Musterstudienplan	Ab 1. Semester
9	Verwendbarkeit des Moduls	Master International Information Systems (from 2018/19 + 2016/17): Module in the section Informatics – Extension Courses (Elective)
10	Studien- und Prüfungsleistungen	Erfolgreiche Bearbeitung aller sechs Übungsaufgaben (Bewertung jeweils mit "ausreichend") und ca. 30-minütige mündliche Prüfung.
11	Berechnung Modulnote	Mündliche Prüfung 30 Minuten (100%)
12	Turnus des Angebots	Jährlich (SS)
13	Arbeitsaufwand	Präsenzzeit: 60 Std, Eigenstudium: 90 Std.
14	Dauer des Moduls	1 Semester
15	Unterrichts- und Prüfungssprache	Deutsch
16	(Vorbereitende) Literatur	George Coulouris, Jean Dollimore, Tim Kindberg, and Gordon Blair. <i>Distributed Systems: Concepts and Design</i> . Addison Wesley, fifth edition, 2011.

		Andrew S. Tanenbaum and Maarten van Steen. <i>Distributed Systems: Principles and Paradigms</i> (2nd Edition). Prentice-Hall, Inc., Upper Saddle River, NJ, USA, 2006.
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Rechnerkommunikation (RK)

1	Modulbezeichnung TEC-93150	Rechnerkommunikation Computer communication	5 ECTS
2	Lehrveranstaltungen	Rechnerkommunikation (Vorlesung) Rechnerkommunikation Übungen (Übung)	2,5 ECTS 2,5 ECTS
3	Lehrende	Prof. German	

4	Modulverantwortliche/r	Prof. German
5	Inhalt	Die Vorlesung vermittelt die Grundlagen der Rechnerkommunikation und durchläuft die Schichten des Internets: • Anwendungsschicht • Transportschicht • Netzwerkschicht • Verbindungsschicht • Physikalische Schicht Anschließend wird Sicherheit als übergreifender Aspekt behandelt. Die Übung beinhaltet praktische und theoretische Aufgaben zum Verständnis der einzelnen Schichten.
6	Lernziele und Kompetenzen	Die Studierenden erwerben • Kenntnisse über zentrale Mechanismen, Protokolle und Architekturen der Rechnerkommunikation (Topologie, Schicht, Adressierung, Wegsuche, Weiterleitung, Flußkontrolle, Überlastkontrolle, Fehlersicherung, Medienzugriff, Bitübertragung) am Beispiel des Internets und mit Ausblicken auf andere Netztechnologien • Kenntnisse über Sicherheit, Leistung und Zuverlässigkeit bei der Rechnerkommunikation • praktische Erfahrung in der Benutzung und Programmierung von Rechnernetzen
7	Empfohlene Voraussetzungen für die Teilnahme	Keine
8	Einpassung in Musterstudienplan	2. oder 4. Semester
9	Verwendbarkeit des Moduls	Master International Information Systems (from 2018/19 + 2016/17): Module in the section Informatics – Extension Courses (Elective)
10	Studien- und Prüfungsleistungen	Klausur (90 Minuten) Hausaufgaben (Übungsleistung)
11	Berechnung Modulnote	Klausur (100%)
12	Turnus des Angebots	jährlich im Sommersemester
13	Arbeitsaufwand	Präsenzzeit 60 Stunden Eigenstudium 90 Stunden
14	Dauer des Moduls	1 Semester
15	Unterrichts- und Prüfungssprache	Deutsch
16	(Vorbereitende) Literatur	Kurose, Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 4th Ed., Addison Wesley, 2007

Kommunikationssysteme (KS-VÜ)

1	Modulbezeichnung MSC-43950	Kommunikationssysteme Communication systems	5 ECTS
2	Lehrveranstaltungen	Kommunikationssysteme (Vorlesung) Übungen zu Kommunikationssysteme (Übung)	2,5 ECTS 2,5 ECTS
3	Lehrende	Prof. German	

4	Modulverantwortliche/r	Prof. German
5	Inhalt	Aus Rechnerkommunikation ist der grundlegende Aufbau von IP-basierten Netzen bekannt, Inhalt von Kommunikationssysteme sind weitere Netztechnologien wie Leitungsvermittlung (ISDN, Sonet/SDH) und Netze mit virtueller Leitungsvermittlung (ATM, MPLS), Multimediakommunikation über paketvermittelte Netze (Streaming, RTP, H.323, SIP, Multicast), Dienstgüte in paketvermittelten Netzen (Integrated Services, RSVP, Differentiated Services, Active Queue Management, Policing, Scheduling), drahtlose und mobile Kommunikation (GSM, UMTS, Wimax, WLAN, Bluetooth, ZigBee u.a. Sensornetze, Mobile IP) sowie Kommunikation in der Fahrzeug- und Automatisierungstechnik. Weiterhin werden Verfahren zum Systemdesign behandelt: Spezifikation von Architekturen und Protokollen (SDL, MSC, ASN.1, UML), Analyseverfahren, Simulation, Messung, Test. In der Übung werden praktische Aufgaben im Labor durchgeführt: ein Labor enthält mehrere IP-Router, Switches und Rechner, IP-Telefone und Telefonie-Software für VoIP, es werden verschiedene Konfigurationen eingestellt und getestet. In weiteren praktischen Versuchen werden detaillierte Einblicke in die Protokolle der Mobilkommunikation gewonnen.
6	Lernziele und Kompetenzen	- Kenntnisse über Technologien bei der Leitungs- und Paketvermittlung in leitungsgebundenen und drahtlosen/mobilen Netzen - praktische Erfahrung in der Konfiguration eines IP-Switch-Router-Netzes mit Multimediaverkehr sowie in der Programmierung vernetzter eingebetteter Systeme
7	Empfohlene Voraussetzungen für die Teilnahme	Rechnerkommunikation
8	Einpassung in Musterstudienplan	3. Semester
9	Verwendbarkeit des Moduls	Master International Information Systems (from 2018/19 + 2016/17): Module in the section Informatics – Extension Courses (Elective)
10	Studien- und Prüfungsleistungen	Klausur (90 Minuten) Erfolgreiche Teilnahme an der Übung ist Voraussetzung für die Teilnahme an der Prüfung. Bei geringer Teilnehmerzahl (< 20) erfolgt die Prüfung mündlich.
11	Berechnung Modulnote	Klausur (100%)
12	Turnus des Angebots	jährlich im Wintersemester
13	Arbeitsaufwand	Präsenzzeit 60 Stunden Eigenstudium 90 Stunden
14	Dauer des Moduls	1 Semester
15	Unterrichts- und Prüfungssprache	Deutsch
16	(Vorbereitende) Literatur	Lehrbuch: Kurose, Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 4th Ed., Addison Wesley, 2007

Dienstgüte von Kommunikationssystemen (DKS)

1	Modulbezeichnung 472330	Dienstgüte von Kommunikationssystemen Quality of service of communication systems	5 ECTS
2	Lehrveranstaltungen	Dienstgüte von Kommunikationssystemen (Vorlesung) Dienstgüte von Kommunikationssystemen Übungen (Übung)	2,5 ECTS 2,5 ECTS
3	Lehrende	Prof. German	

4	Modulverantwortliche/r	Prof. German
5	Inhalt	Zunächst wird ein Überblick über Systeme und Technologien zur Erzielung von Dienstgüte gegeben. Aufbauend auf der Lehrveranstaltung "Kommunikationssysteme" werden u.a. ATM, Integrated Services, Differentiated Services, MPLS, GPRS, UMTS, WLANs, Bluetooth und WIMAX auf diesen Aspekt hin untersucht. Dann werden unterschiedliche Methoden vorgestellt, mit denen Systeme bezüglich ihrer Dienstgüte bewertet und ausgelegt werden können: Messung (HW-, SW-, Hybrid-Monitoring, Benchmarks, Leistungstests), Analytische Modellierung (Warteschlangenmodelle, stochastische Prozesse, Petri-Netze) und Simulation (OPNET, ns2, OmNET++, formale Beschreibungstechniken). Ergänzend wird der Network Calculus vorgestellt, mit dem Garantien für Dienstgüteeigenschaften ermittelt werden können. Alle Methoden werden an Beispielen demonstriert.
6	Lernziele und Kompetenzen	Die Studierenden erwerben • Kenntnisse in Methoden zur Modellierung und Bewertung von quantitativen, nicht-funktionalen Eigenschaften von vernetzten Systemen (Messung, Modellierung, Analyse, Simulation) • Kenntnisse in Mechanismen von vernetzten Systemen zur Erzielung von Dienstgüte
7	Empfohlene Voraussetzungen für die Teilnahme	Kommunikationssysteme
8	Einpassung in Musterstudienplan	4. Semester
9	Verwendbarkeit des Moduls	Master International Information Systems (from 2018/19 + 2016/17): Module in the section Informatics – Extension Courses (Elective)
10	Studien- und Prüfungsleistungen	Klausur (90 Minuten) Erfolgreiche Teilnahme an der Übung ist Voraussetzung für die Teilnahme an der Prüfung. Bei geringer Teilnehmerzahl (< 20) erfolgt die Prüfung mündlich.
11	Berechnung Modulnote	Klausur (100%)
12	Turnus des Angebots	jährlich im Sommersemester
13	Arbeitsaufwand	Präsenzzeit 60 Stunden Eigenstudium 90 Stunden
14	Dauer des Moduls	1 Semester
15	Unterrichts- und Prüfungssprache	Deutsch
16	(Vorbereitende) Literatur	Lehrbuch: Kurose, Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 4th Ed., Addison Wesley, 2007

Fahrzeugkommunikation (FzK)

1	Modulbezeichnung 716033	Fahrzeugkommunikation Vehicular networks	5 ECTS
2	Lehrveranstaltungen	Fahrzeugkommunikation (Vorlesung) Fahrzeugkommunikation Übungen (Übung)	2,5 ECTS 2,5 ECTS
3	Lehrende	Dipl.-Inf. Eckhoff	

4	Modulverantwortliche/r	Dipl.-Inf. Eckhoff, Prof. German
5	Inhalt	Die Vorlesung „Fahrzeugkommunikation“ [FzK] ist in zwei Blöcke gegliedert: Zunächst führt die Vorlesung in die fahrzeuginterne Vernetzung ein, behandelt Vernetzungsarchitekturen, Bussysteme und Steuergeräte, Fahrerassistenzfunktionen, Multimedia und Systemarchitekturen. Den Abschluss bilden Betrachtungen zu Security und Safety in der fahrzeug-internen Vernetzung. Als zweiten Block gibt die Vorlesung einen Überblick über Themen der externen Kommunikation von und mit Fahrzeugen, behandelt Systemarchitekturen zur Vernetzung von Fahrzeugen untereinander und mit Infrastruktur, Medienzugriffsverfahren verbreiteter Lösungen, Protokolle von Verkehrsinformationssystemen. Sie schließt wiederum mit Betrachtungen zu Safety und Security - erweitert um die in diesem Themengebiet besonders relevanten Fragestellungen rund um die Wahrung der Privatsphäre von Nutzern. Das Modul wird für einen Abschluss mit Studienschwerpunkt „Informatik in der Fahrzeugtechnik“ anerkannt. Sie setzt Grundkenntnisse in Rechnernetzwerken voraus und richtet sich so schwerpunktmäßig an Studierende aus Informatik, IuK und CE ab dem 5. Semester.
6	Lernziele und Kompetenzen	Ziel der Vorlesung ist es, Wissen anhand von Beispielen und Interaktion mit den Studierenden zu vermitteln. Im Rahmen der Übung werden Protokolle aus der internen Fahrzeugkommunikation implementiert, analysiert und anschliessend evaluiert. Anschließend soll Wissen über die Simulation von Netzwerken durch selbstständiges Arbeiten vermittelt werden. Es folgt eine Analyse von aktuellen Lösungen aus dem Bereich der Verkehrssimulation, die im nächsten Schritt mit der Netzwerksimulation gekoppelt wird, um Funknetzwerkprotokolle und -anwendungen mit der Mobilität von Fahrzeugen zu implementieren und evaluieren. Darüber hinaus erstellen die Studierenden eigenständig Lösungen für Anforderungen aus dem Bereich Car-2-X-Kommunikation, bewerten diese auf ihre praktische Anwendbarkeit hin und entwerfen in Kleingruppen Verbesserungsvorschläge dazu.
7	Empfohlene Voraussetzungen für die Teilnahme	Keine
8	Einpassung in Musterstudienplan	2. oder 4. Semester
9	Verwendbarkeit des Moduls	Master International Information Systems (from 2018/19 + 2016/17): Module in the section Informatics – Extension Courses (Elective)
10	Studien- und Prüfungsleistungen	mündliche Prüfung (30 Minuten)
11	Berechnung Modulnote	Mündliche Prüfung (100%)
12	Turnus des Angebots	jährlich im Sommersemester
13	Arbeitsaufwand	Präsenzzeit 60 Stunden Eigenstudium 90 Stunden
14	Dauer des Moduls	1 Semester

15	Unterrichts- und Prüfungssprache	Deutsch
16	(Vorbereitende) Literatur	Keine

Smart grids und Elektromobilität

1	Modulbezeichnung 623734	Smart grids und Elektromobilität	5 ECTS
2	Lehrveranstaltungen	Smart grids und Elektromobilität (Vorlesung) Übungen zu Smart grids und Elektromobilität (Übung)	2,5 ECTS 2,5 ECTS
3	Lehrende	Marco Pruckner	

4	Modulverantwortliche/r	Marco Pruckner
5	Inhalt	Dieser Kurs dient als Einführung in den neuen multi-disziplinären Bereich Smart Grids. Dabei wird ein Überblick zu den wesentlichen neuen Aspekten moderner Technologien in Erzeugung, Übertragung und Verteilung gegeben. Zudem werden relevante Aspekte der Kommunikationstechnologien wiedergegeben, die zur intelligenten Koordinierung zwischen den verschiedenen Einheiten innerhalb des Stromnetzes eingesetzt werden. Neben einer Einführung der Konzepte der verschiedenen Komponenten des Smart Grids, einschließlich der Integration erneuerbarer Energien, Energiespeicher und Demand Side Management wird die Elektromobilität und die Integration von Elektrofahrzeugen in das Stromnetz einen weiteren Schwerpunkt dieses Kurses bilden. Die Vorlesung behandelt zentrale Fragestellungen zu Smart Grids und Elektromobilität: • Vision und Strategie für die elektrischen Netze der Zukunft • Smarte Erzeugung elektrischer Energie • Aufbau und Betrieb von Übertragungs- und Verteilungsnetzen • Informations- und Kommunikationstechnologien als Rückgrat des Smart Grids • Technologien für das Laden von Elektrofahrzeugen • Zusammenspiel von Elektrofahrzeugen und dem Energiesystem • Umweltaspekte, einschließlich CO₂-Emissionen
6	Lernziele und Kompetenzen	Die Studierenden • unterscheiden Probleme und Herausforderungen die mit den künftigen Stromnetzen verbunden sind • erfassen die Vorteile und die Anwendungsmöglichkeiten, die beim Einsatz von IKT im Stromnetz möglich sind, wie z.B. Demand Response • analysieren verschiedene Probleme, die beim Einsatz von IKT im Stromnetz entstehen, z.B. Datenschutzprobleme • erlernen verschiedene Technologien zur Erzeugung und Verteilung von Energie kennen • kennen die Rolle von Elektromobilität sowie die speziellen Herausforderungen zur Integration von Elektrofahrzeugen in das bestehende bzw. zukünftige Stromnetz
7	Empfohlene Voraussetzungen für die Teilnahme	Keine
8	Einpassung in Musterstudienplan	3. Semester
9	Verwendbarkeit des Moduls	Master International Information Systems (from 2018/19 + 2016/17): Module in the section Informatics – Extension Courses (Elective)
10	Studien- und Prüfungsleistungen	mündliche Prüfung (30 Minuten) unbenotete Studienleistung, zu erwerben durch erfolgreiche Teilnahme an den Übungen
11	Berechnung Modulnote	Mündliche Prüfung (100%)
12	Turnus des Angebots	jährlich im Sommersemester

13	Arbeitsaufwand	Präsenzzeit 60 Stunden Eigenstudium 90 Stunden
14	Dauer des Moduls	1 Semester
15	Unterrichts- und Prüfungssprache	Deutsch
16	(Vorbereitende) Literatur	Keine

Modellierung, Optimierung und Simulation von Energiesystemen (MOSES)

1	Modulbezeichnung 337521	Modellierung, Optimierung und Simulation von Energiesystemen (MOSES) Modeling, Optimization and Simulation of Energy Systems	5 ECTS
2	Lehrveranstaltungen	V + Ü: Modellierung, Optimierung und Simulation von Energiesystemen (2+2 SWS)	5 ECTS
3	Lehrende	Prof. Pruckner	

4	Modulverantwortliche/r	Prof. Pruckner
5	Inhalt	In der Vorlesung Modellierung, Optimierung und Simulation von Energiesystemen werden systemtechnische Planungs- und Analysemethoden behandelt, die zur Lösung komplexer und interdisziplinärer Entscheidungsaufgaben in der Energiewirtschaft eingesetzt werden. Dabei werden die wichtigsten Methoden und Verfahren anhand praktischer Fragestellungen (z.B. Ausbau erneuerbarer Energien, Zunahme der Elektromobilität) aus der energiepolitischen Planung vermittelt und die Bewältigung technisch-ökonomischer Probleme verdeutlicht. Übersicht der Vorlesungsinhalte: • Einführung in die Energiewirtschaft und Systemtechnik • Systemtechnische Methoden der Energieplanung ◦ Datenanalyse (Regressionsanalysen, Clusteranalyse, Zeitreihenanalyse) ◦ Mathematische Optimierung (Lineare Programmierung, Gemischt-ganzzahlige lineare Programmierung, dynamische Optimierung) ◦ Simulation (Diskrete Ereignissimulation, System Dynamics, agentenbasierte Simulation) ◦ Input-Output-Analyse, Gleichgewichtsmodelle ◦ Behandlung von Unsicherheiten • Energiemodelle ◦ Energienachfragemodelle ◦ Kraftwerkseinsatzmodelle ◦ Kraftwerksausbaumodelle ◦ Modelle für Energieversorgungsmodelle Zu den eingesetzten Tools zählen die Statistiksoftware R, AnyLogic und IpSolve. Vorkenntnisse im Umgang mit diesen Werkzeugen ist nicht zwingend erforderlich. In den Übungen werden Einführungen in die genannten Softwarepakete gegeben.
6	Lernziele und Kompetenzen	Die Studierenden • unterscheiden Probleme und Herausforderungen, die mit dem Energieumstieg verbunden sind, • erfassen die Vorteile und die Anwendungsmöglichkeiten computergestützter Planungsmethoden im Energiebereich, • analysieren verschiedene Problemstellungen und setzen Lösungen dafür um, • erlernen verschiedene Methoden der Datenanalyse, Optimierung und Simulation
7	Empfohlene Voraussetzungen für die Teilnahme	Keine
8	Einpassung in Musterstudienplan	Drittes Semester
9	Verwendbarkeit des Moduls	Master International Information Systems (from 2018/19 + 2016/17): Module in the section Informatics – Extension Courses (Elective)
10	Studien- und Prüfungsleistungen	mündliche Prüfung unbenotete Studienleistung, zu erwerben durch erfolgreiche Teilnahme an den Übungen
11	Berechnung Modulnote	mündliche Prüfung (100%)
12	Turnus des Angebots	jährlich im Wintersemester

13	Arbeitsaufwand	Präsenzzeit: 60 h Eigenstudium: 90 h
14	Dauer des Moduls	1 Semester
15	Unterrichts- und Prüfungssprache	Deutsch
16	(Vorbereitende) Literatur	Vorlesungsskript wird ausgegeben

Seminar Applied Software Engineering (OSS-SEMI)

1	Module name 93186	Seminar Applied Software Engineering	5 ECTS
2	Courses/lectures	Seminar Applied Software Engineering	5 ECTS
3	Lecturers	Prof. Dirk Riehle	

4	Module coordinator	Prof. Dirk Riehle
5	Contents	This module lets students fulfill their degree program's seminar obligation by fulfilling a seminar topic in software engineering and/or open source. We prefer that you use one of our existing courses for your seminar obligation, but are willing to have you for a one-off topic if none of our courses fit. Seminar topics should be in the domain of (applied) software engineering and may or may not include open source software as a topic. The work results are likely to be a written seminar thesis and presentation, but this depends on the specific topic we agreed upon.
6	Learning objectives and skills	Students learn to analyze and summarize a software engineering topic and to present it in class
7	Recommended prerequisites	None
8	Integration in curriculum	Second/third semester
9	Module compatibility	Master International Information Systems (from 2018/19): Module in the section Informatics – Architectures & Development (Elective)
10	Method of examination	Project presentation and project report
11	Grading procedure	Project presentation: 20% of the final grade Final project report: 80% of the final grade
12	Module frequency	SS, 1. Wdh. WS 2021/2022
13	Workload	Contact hours: 0 h Independent study: 150 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	None

Study abroad courses

1.	Module name IIS-57265	Study abroad courses (Informatics)	¹⁾
2.	Courses/lectures	Study abroad courses (Informatics)	¹⁾
3.	Lecturers	Staff at exchange university	

4.	Module coordinator	Prof. Meyer-Wegener, Prof. Riehle, Prof. Saglietti, Prof. Eskofier
5.	Contents	Courses students will be attending during the exchange semester in one of the partner universities or others should fit into the area Informatics thus extending the student's knowledge and competencies in this field of study. The suitability of the courses will be assessed by the programme coordinator.
6.	Learning objectives and skills	Students acquire additional knowledge and competencies in their field of study
7.	Recommended prerequisites	Learning agreement
8.	Integration in curriculum	Third semester
9.	Module compatibility	Master in International Information Systems: Module in the section IIS Informatics (Elective)
10.	Method of examination	In accordance with exam regulations of the exchange university
11.	Grading procedure	In accordance with grading key and credits of the course
12.	Module frequency	In accordance with the curriculum of the exchange university
13.	Workload	In accordance with the specific course and the credits of the course
14.	Module duration	1 semester
15.	Teaching and examination language	Tbd in the course
16.	(Recommended) reading	Tbd in the course

¹⁾ 5, 10 or 15 ECTS

VI Seminar International Information Systems



As part of the curriculum, the “Seminar International Information Systems” module is mandatory. Students have to choose one out of the offered options.



Das „Seminar International Information Systems“-Modul ist eine Pflichtveranstaltung. Die Studierenden müssen eine der Optionen absolvieren.

Interdisciplinary business seminar (IBS)

1	Module name IIS-57200	Interdisciplinary business seminar	5 ECTS
2	Courses/lectures IIS72001	Interdisciplinary business seminar	5 ECTS
3	Lecturers	Prof. Bodendorf and colleagues	

4	Module coordinator	Prof. Bodendorf
5	Contents	This seminar confronts students with real international IS business challenges in an interdisciplinary context. Students learn how to address real-world problems and to create application-oriented solutions based on sound methods rooted in robust theoretical frameworks and a well-founded evidence base.
6	Learning objectives and skills	The students • can independently define new usage-oriented problems in e-business, considering the economic impact on companies, and solve them with the aid of suitable methods. • discuss problem-solving approaches in groups and present their work results.
7	Recommended prerequisites	Command of English
8	Integration in curriculum	Second or third semester
9	Module compatibility	Master International Information Systems (from 2018/19 + 2016/17): Module in the section Seminar International Information Systems
10	Method of examination	Seminar paper and presentation (Seminararbeit und Präsentation)
11	Grading procedure	Seminar paper (100%) and presentation (passed) (Seminararbeit (100%) und Präsentation (bestanden))
12	Module frequency	Each semester
13	Workload	Attendance: 30 h Self-study: 120 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	Will be announced at the beginning of the course.

Nailing your thesis (NYT)

1	Module name IIS-57190	Nailing your thesis	5 ECTS
2	Courses/lectures IIS480491 IIS580491	Lecture: Nailing your thesis (4 SWS) Exercise: Nailing your thesis (4 SWS)	2,5 ECTS 2,5 ECTS
3	Lecturers	Prof. Riehle	

4	Module coordinator	Prof. Riehle, M.B.A.
5	Contents	This course teaches students how to perform research work and how to publish the results. According to most Prüfungsordnungen Bachelor or Master theses have to be scientific work, and this class teaches students how to do so. The class consists of a 2 SWS lecture part and a 2 SWS exercise part. It is run as a 3h block with a short break in between. With homework and self-study, the course effort is 5 ECTS. <u>If students pick up one of the offered research projects, total effort doubles to 10 ECTS (see Research Project Applied Software Engineering). The research project does not require additional time in class.</u> The lecture part covers the following topics: • Science and society • The research process • Exploratory research • Confirmatory research • Writing a thesis/paper • Scientific community The exercise associated with the lecture involves reading, writing, and evaluating weekly homework, but no research project. Taken as lecture + exercises, student effort totals 5 ECTS. Students can pick up a research project for an additional 5 ECTS. Students perform research and write a (short) research paper (<u>see Research Project Applied Software Engineering</u>). The syllabus, schedule, literature, and more can be found at http://nythesis.com. Please sign up for the course on StudOn (link accessible through schedule spreadsheet) as soon as possible. In addition to the traditional classroom setting, the course may be offered online (through Adobe Connect at https://webconf.vc.dfn.de/dirkriehle).
6	Learning objectives and skills	• Understand how to perform research • Understand how to write a research thesis
7	Recommended prerequisites	None
8	Integration in curriculum	Third semester Only possible, if the elective "Nailing your Thesis" has not been taken yet.
9	Module compatibility	Master International Information Systems (from 2018/19 + 2016/17): Module in the section Seminar International Information Systems
10	Method of examination	Student work comprises

		- class participation (aktive Teilnahme am Unterricht) - student presentations (Präsentationen) - For more information see http://wp.me/pDU66-DT
11	Grading procedure	• Grades are based on linearly combining the individual grades from class participation and student presentations (Gewichtete Note aus der Teilnahme am Unterricht und den Präsentationen).
12	Module frequency	Every two semesters
13	Workload	60h in class, 90h pre- and post-work
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	See http://nythesis.com

Value co-creation (VCC)

1	Module name IIS-57220	Value co-creation	5 ECTS
2	Courses/lectures IIS72201	Value co-creation	5 ECTS
3	Lecturers	Prof. Möslin and colleagues	

4	Module coordinator	Prof. Möslin
5	Contents	Producers of goods or service providers are not the only ones re-sponsible for the creation of value in business interactions. Various authors have lately turned the attention to the role of customers as co-creators. In this seminar, we will study the current literature on the topic and discuss it from a practical perspective.
6	Learning objectives and skills	The students: • gain deeper insight into the theories of value co-creation. • learn to work with scientific papers and apply the results. • develop skills in collaborative interaction within the context of the seminar.
7	Recommended prerequisites	None
8	Integration in curriculum	Third semester
9	Module compatibility	Master International Information Systems (from 2018/19 + 2016/17): Module in the section Seminar International Information Systems
10	Method of examination	Seminar work and presentation (Präsentation, Seminararbeit)
11	Grading procedure	Seminar paper (50%) and presentation (50%) (Präsentation, Seminararbeit)
12	Module frequency	Each WS
13	Workload	Contact hours: 30 h Independent study: 120 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	Literature will be announced and distributed in the first sessions.

Research seminar on data management (RDM)

1	Modulbezeichnung IIS-57180	Research seminar on data management	5 ECTS
2	Lehrveranstaltungen IIS71801	Master-Seminar Datenmanagement (2 SWS)	5 ECTS
3	Lehrende	Prof. Lenz, Mitarbeiter INF6	

4	Modulverantwortliche/r	Prof. Lenz
5	Inhalt	Ein Seminar im Master-Studium soll die Fähigkeit vermitteln, sich anhand von Fachliteratur und Forschungsberichten über ein aktuelles Problem (hier aus dem Gebiet der Datenbanken) selbständig zu informieren, sich in einem mündlichen Vortrag von 30 Minuten damit auseinanderzusetzen und seine Auffassung dazu in einer Diskussion zu vertreten. Im Unterschied zu einem Bachelor-Seminar geht es auch noch darum, unterschiedliche Begriffsverwendungen zu erkennen und zu vereinheitlichen. (Im Bachelor-Seminar beschränkt sich die Fachliteratur auf wenige Quellen, u.U. sogar nur eine einzige, die eine einheitliche Begriffsbildung aufweisen.) Die systematische Vorgehensweise bei der Erarbeitung und Aufbereitung des Stoffs steht eindeutig im Vordergrund; im Vergleich dazu ist das Thema des Seminars nachrangig. Für Studierende der Informatik ist die passive Beherrschung der englischen Sprache eine unabdingbare Voraussetzung. Deshalb sollten die englischsprachigen Quellen nach Möglichkeit nicht übersetzt, sondern im Original gelesen werden. Es zeigt sich immer wieder, dass Übersetzungen ohne ausreichendes Verständnis des Texts ohnehin unbrauchbar sind. Falls der Wunsch besteht, auch die aktive Beherrschung der englischen Sprache zu üben, kann der Seminarvortrag auf Englisch gehalten werden.
6	Lernziele und Kompetenzen	Die Studierenden: • arbeiten mit wissenschaftlicher Literatur; • vereinheitlichen unterschiedliche Begriffsbildungen; • fassen ihre Exzerpte in einem Vortrag zusammen; • formulieren eine kurze Zusammenfassung des Vortrags (Extended Abstract) • vertreten ihre Auffassung in einer Diskussion • führen ggf. relevante Software in Demonstrationen vor.
7	Empfohlene Voraussetzungen für die Teilnahme	Grundlagen von Datenbanksystemen – im Umfang der Module KonzMod und IDB im Bachelorstudium Informatik oder vergleichbarer Module
8	Einpassung in Musterstudienplan	2. oder 3. Semester
9	Verwendbarkeit des Moduls	Master International Information Systems (from 2018/19 + 2016/17): Module in the section Seminar International Information Systems
10	Studien- und Prüfungsleistungen	Ausarbeitung, Präsentationsfolien, Vortrag
11	Berechnung Modulnote	30% Ausarbeitung, 30% Präsentationsfolien, 40% Vortrag
12	Turnus des Angebots	unregelmäßig, Winter- oder Sommersemester
13	Arbeitsaufwand	Präsenzzeit: 2 x 15 = 30h Vorbereitungszeit: 120h
14	Dauer des Moduls	1 Semester
15	Unterrichts- und Prüfungssprache	Deutsch oder Englisch
16	(Vorbereitende) Literatur	Bücher über wissenschaftliches Arbeiten (gibt es in sehr großer Zahl)

		DEININGER, Marcus ; LICHTER, Horst ; LUDEWIG, Jochen ; SCHNEIDER, Kurt: Studien-Arbeiten : ein Leitfaden zur Vorbereitung, Durchführung und Betreuung von Studien-, Diplom- und Doktorarbeiten am Beispiel Informatik. 2., durchges. Aufl., Zürich : vdf, Stuttgart : Teubner, 1993. - ISBN 3-519-12156-5 und 3-7281-1961-X.
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Internet of things and industrial services seminar (IoTISS)

1	Module name IIS-54350	Internet of things and industrial services seminar	5 ECTS
2	Courses/lectures	Internet of things and industrial services seminar (4 SWS)	5 ECTS
3	Lecturers	Prof. Matzner and assistants	

4	Module coordinator	Prof. Matzner	
5	Contents	Cyber-physical Systems (CPS) are physical products that are equipped with embedded hardware and software, that may interact with their environment through sensors and actuators, and that may be networked with remote computers. Examples are modern networked cars and production machines in the smart factory. CPS pave the way for new digital business models based on CPS-enabled service offerings. This seminar addresses the phenomenon of digital industrial services based on cyber-physical systems and the Internet-of-Things.	
6	Learning objectives and skills	The students - will learn about different uses of CPS in digital industrial service systems. - can adopt one of different research methods (literature-study, empirical or design research) in order to address a specific research question or research problem. - will gain theoretical knowledge about digital industrial service systems based on cyber-physical systems and the Internet-of-Things as well as relevant technologies in this domain - will train their research, writing, and presentation skills. - will learn how to set up and conduct an IoT service project.	
7	Recommended prerequisites	None	
8	Integration in curriculum	Third semester	
9	Module compatibility	Master International Information Systems (from 2018/19 + 2016/17): Module in the section Seminar International Information Systems Master FACT (Vertiefungsbereich, Modulgruppe Interdisziplinäre Module) Master WING (wirtschaftswissenschaftliche Modulgruppe M7) Master International Production Engineering and Management (International Elective Modules M6)	
10	Method of examination	Seminar paper (tw. in Gruppenarbeit) (20 ± 5 pages) Final presentation (tw. in Gruppenarbeit) (20 minutes)	
11	Grading procedure	Seminar paper (70%) Presentation (30%)	
12	Module frequency	Each semester	
13	Workload	Contact hours: 30 h Independent study: 120 h	
14	Module duration	1 semester	
15	Teaching and examination language	English	
16	(Recommended) reading	All relevant material will be provided during the seminar.	

Digitalization of work and life

1	Module name IIS-56430	Digitalization of work and life	5 ECTS
2	Courses/lectures	Seminar: Digitalization of work and life (4 SWS)	5 ECTS
3	Lecturers	Prof. Dr. Sven Laumer	

4	Module coordinator	Prof. Dr. Sven Laumer
5	Contents	Digitalization provides opportunities for a better quality of life, new business models and efficient management. However, it also has a "dark" side, as people may be stressed or become addicted to digital technologies. As part of this research seminar, various research questions of digitalization in business and society are discussed and students carry out their own research project. To support their own research projects theories and methods of information systems research will be introduced. The seminar is offered as a block seminar. An introduction is provided at the beginning of semester. Students work on their seminar thesis during the semester. The results are presented and discussed at the end of the semester during a block seminar.
6	Learning objectives and skills	The research seminar prepares students for a master's thesis, so that they are able to answer a concrete research question in the field of digital transformation by applying an information system's research method.
7	Recommended prerequisites	12, number of participants is limited, please see website for details for the application process (no first come, first serve approach)
8	Integration in curriculum	Second or forth semester
9	Module compatibility	Master International Information Systems (from 2018/19 + 2016/17): Module in the section Seminar International Information Systems
10	Method of examination	Seminar paper and presentation
11	Grading procedure	Seminar paper (70%) and presentation (30%)
12	Module frequency	Summer term
13	Workload	Contact hours: 30 h Independent study: 120 h
14	Module duration	1 Semester
15	Teaching and examination language	German, English on demand
16	Recommended reading	Grover, Varun. "Are we losing out with digitization?." Journal of Information Technology Case and Application Research 17.1 (2015): 3-7. Hess, Thomas, et al. "Digital Life as a Topic of Business and Information Systems Engineering?." Business & Information Systems Engineering 6.4 (2014): 247-253. Legner, Christine, et al. "Digitalization: opportunity and challenge for the business and information systems engineering community." Business & information systems engineering 59.4 (2017): 301-308. Riedl, René, et al. "On the relationship between information management and digitalization." Business & Information Systems Engineering (2017): 1-8.

User experience research (UXR)

1.	Module name IIS-57440	User experience (UX) research seminar	5 ECTS
2.	Courses/lectures	Seminar: User experience (UX) research (4 SWS)	5 ECTS
3.	Lecturers	Prof. Dr. Steffi Haag	
4.	Module coordinator	Prof. Dr. Steffi Haag	
5.	Contents	User experience (UX) research systematically analyzes users and their requirements in order to shed light on the process of designing the experiences users make in interaction with digital technologies and policies. During the seminar, (groups of) students employ theories, concepts, tools, and methods (e.g., interviews, surveys, experiments) to analyze research problems regarding users' cognitions, emotions, and behaviors while interacting with state-of-the-art digital technologies and derive implications for technology development, corporate strategy, new business models, and innovations. Approach and results of the research projects are written down in a seminar paper, presented, and discussed with peers and industry experts during blocked sessions. Topics are introduced and assigned in the first session. During the semester, students work on their seminar thesis. The results are presented and discussed in the middle and at the end of the semester.	
6.	Learning objectives and skills	Students can prepare and interpret different theoretical and methodological approaches to user research. They • can analyze scientific literature to independently define relevant research problems • can use quantitative or qualitative research methods to analyze those problems • can write and review seminar papers • can critically reflect, present, and discuss research design and results within the audience of the seminar • can give adequate feedback to complex challenges • develop skills in collaborative interaction with peers.	
7.	Recommended prerequisites	None The number of participants is limited. Please see website for details on the application process!	
8.	Integration in curriculum	1.– 4. semester	
9.	Module compatibility	Master International Information Systems (from 2018/19 + 2016/17): Module in the section Seminar International Information Systems Master Wirtschaftsingenieurwesen Master in Management: Vertiefungsbereich "Value Creation & Digital Transformation" oder „Entrepreneurship & Innovation“ Master in International Business Studies: Free Specialization Module (FSM)	
10.	Method of examination	Seminar paper, presentation, and class participation, partly in groups.	
11.	Grading procedure	Seminar paper (60%), presentation (30%), and class participation (10%)	
12.	Module frequency	Each SS.	
13.	Workload	Contact hours: 30h Independent study: 120h	
14.	Module duration	1 Semester, in blocked sessions	
15.	Teaching and examination language	Irregularly, English or German. Please see website.	
16.	(Recommended) reading	Relevant literature is provided during the seminar.	

Designing Information Systems for Behavior Change (DIS)

1	Module name IIS-57469	Designing Information Systems for Behavior Change: Practical Applications	5 ECTS
2	Courses/lectures 74671	Seminar: Designing Information Systems for Behavior Change: Practical Applications	5 ECTS
3	Lecturers	Prof. Dr. Verena Tiefenbeck	
4	Module coordinator	Prof. Dr. Verena Tiefenbeck	
5	Contents	Information systems increasingly provide the necessary tools to collect, analyze, and communicate data about individuals both in organizational and private contexts. This makes it possible to implement data-driven behavioral interventions using various devices including mobile phones, fitness trackers, or electricity smart meters. While some of these products successfully induce behavior change, others completely fail. The seminar introduces students to key concepts from behavioral economics and psychology and how to use them to build effective applications for behavior change in relevant domains including sustainability, healthcare or household spending. At the beginning of the semester, an introduction to the topic is provided and topics for the seminar thesis are assigned. During the semester, students work on their seminar thesis. The results are presented and discussed at the end of the semester.	
6	Learning objectives and skills	The research seminar prepares students for a master's thesis, so that they are able to answer a concrete research question in the field of digital transformation. More specifically, students ... - Understand important behavioral theories - Get a first impression on theory testing - Relate the insights to practical challenges - Understand the limitations of the theories - Structure and plan a research-related assignment - Read and evaluate scientific publications - Write a scientific report - Use and cite literature sources - Present research findings to an audience	
7	Recommended prerequisites	None	
8	Integration in curriculum	Second or forth semester	
9	Module compatibility	Master International Information Systems (from 2018/19 + 2016/17): Module in the section Seminar International Information Systems	
10	Method of examination	Seminar paper and presentation	
11	Grading procedure	Seminar paper (70%), presentation (30%) Es handelt sich um eine einheitliche Prüfung, bei der die einzelnen Teilleistungen untrennbar miteinander verbunden sind. Für das Bestehen des Moduls müssen nach § 19 Abs. 1 Satz 4 MPOWIWI in der jeweils geltenden Fassung alle Teilleistungen in demselben Semester bestanden werden. Wegen des untrennbaren Bezugs der Teilleistungen aufeinander ist abweichend von § 25 Abs. 1 Satz 2 MPOWIWI eine Wiederholung nur einer der nicht bestandenen Teilleistungen nicht möglich. Das Nichtbestehen einer der Teilleistungen erfordert die Wiederholung der gesamten Prüfung.	

12	Module frequency	Each summer term
13	Workload	Contact hours: 30 h Independent study: 120 h
14	Module duration	1 semester
15	Teaching and examination language	English
16	(Recommended) reading	Will be announced in class

VII Master thesis



As part of the curriculum “Master thesis” is a mandatory module.



Das Modul „Masterarbeit“ ist verpflichtender Bestandteil des Curriculums.

Master Thesis

1	Modulbezeichnung IIS1999	Masterarbeit (Master's thesis)	30 ECTS
2	Lehrveranstaltungen	Masterarbeit	30 ECTS
3	Lehrende	Prof. Amberg / Prof. Bodendorf / Prof. Möslin / Prof. Matzner / Prof. Laumer / Prof. Harth / Prof. Haag / Prof. Tiefenbeck / Prof. Zschech / Prof. Morschheuser / Prof. Kraus / Prof. Riehle / Prof. Saglietti / Prof. Freiling / Prof. Tielemann / Prof. Kleinöder / Prof. German / Dr. Grosso / Prof. Eskofier / Prof. Philippsen / Prof. Lenz / Prof. Maier	

4	Modulverantwortliche/r	Prof. Bodendorf stellvertretend für die Dozierenden im Studiengang
5	Inhalt	Die Masterarbeit beinhaltet das Verfassen einer konzeptionellen oder empirischen Arbeit zu einem Thema aus dem Bereich Wirtschaftsinformatik. Die Masterarbeit sollte einen Bezug zu internationalen Aspekten der Wirtschaftsinformatik herstellen.
6	Lernziele und Kompetenzen	Die Studierenden sind in der Lage, innerhalb einer vorgegebenen Frist ein Thema bzw. eine Fragestellung aus dem Bereich Wirtschaftsinformatik selbstständig mit wissenschaftlichen Methoden zu bearbeiten sowie die Erkenntnisse prägnant aufzuarbeiten und kompetent zu interpretieren.
7	Empfohlene Voraussetzungen für die Teilnahme	• Voriger Besuch der Veranstaltungen des 1.-3. Semesters • Mit der Anmeldung zur Masterarbeit im Studiengang International Information Systems muss ein Nachweis über den bereits absolvierten oder den geplanten verpflichtenden Auslandsaufenthalt erbracht werden.
8	Einpassung in Musterstudienplan	4. Semester
9	Verwendbarkeit des Moduls	Master International Information Systems
10	Studien- und Prüfungsleistungen	Masterarbeit: schriftliche Arbeit
11	Berechnung Modulnote	Masterarbeit 100%
12	Turnus des Angebots	Nach Maßgabe des jeweiligen Lehrstuhls
13	Arbeitsaufwand	Präsenzzeit: 0 h Eigenstudium: 900 h
14	Dauer des Moduls	6 Monate
15	Unterrichts- und Prüfungssprache	Deutsch oder Englisch
16	(Vorbereitende) Literatur	Aktuelle Forschungsliteratur